Consulting Engineer

April 1960

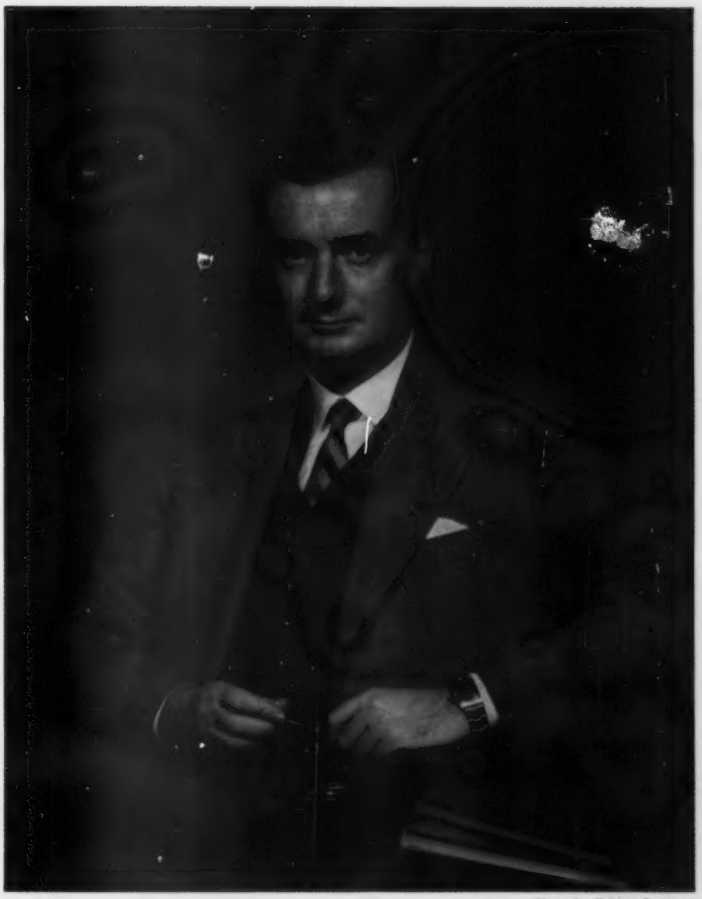

Photo by Fabian Bachrach

ROBERTO ROCCA and his father, Agostino Rocca, took $10,000, a business philosophy from an essay by Tolstoy, and a rare combination of mature experience and youthful engineering talent and, in less than 15 years, created an international engineering firm grossing $27 million a year. The firm, Techint Engineering Company, has headquarters in Milan, and currently has offices in

Continued on Page 8

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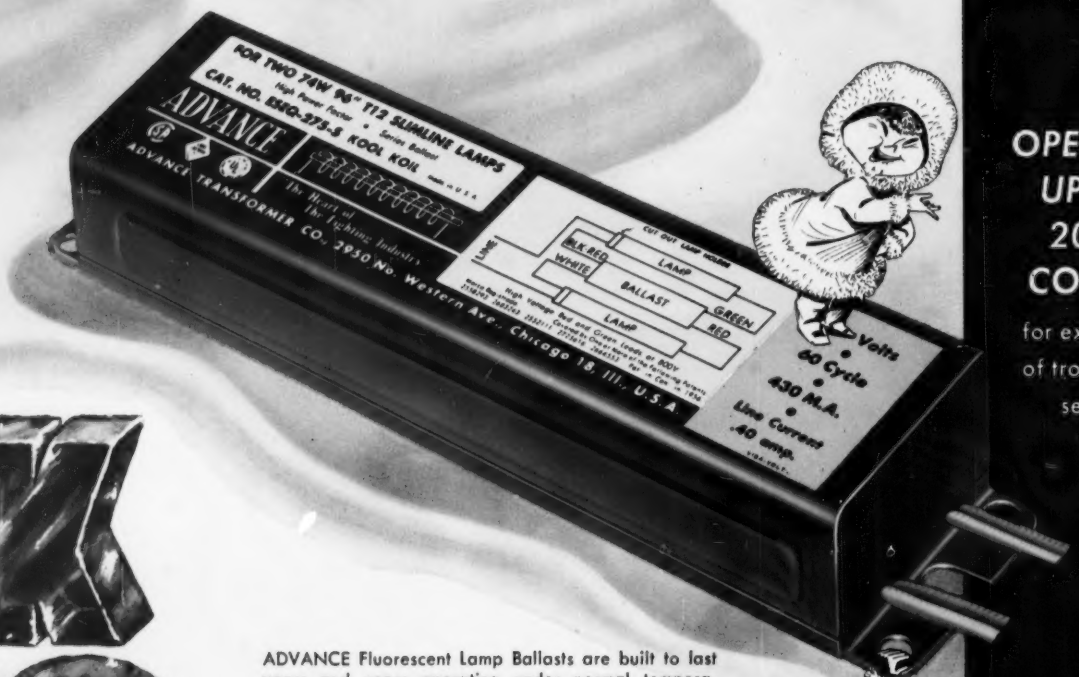

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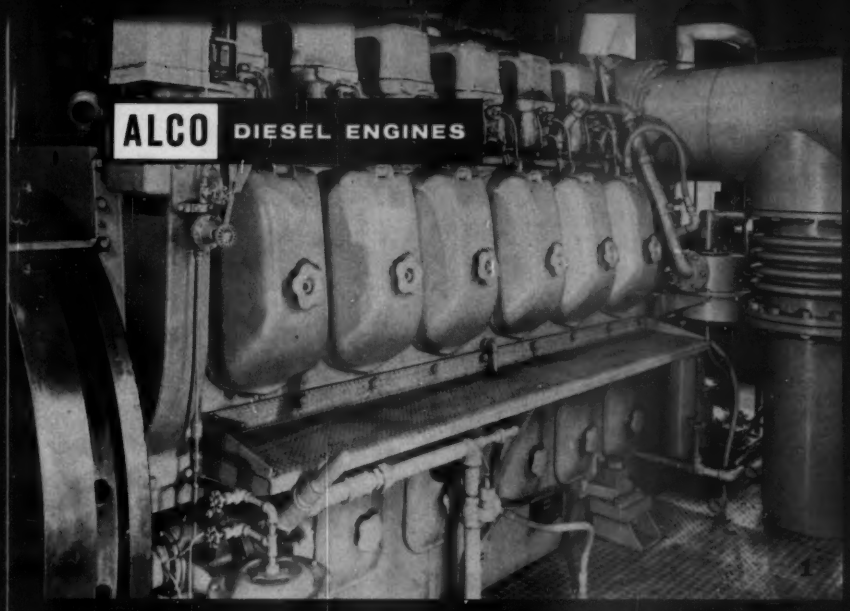

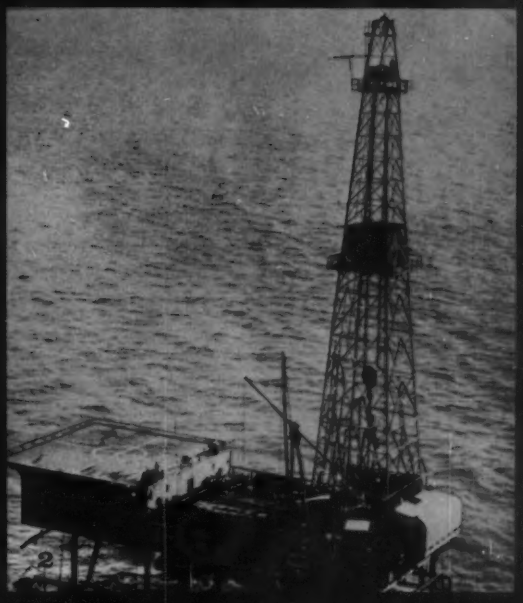

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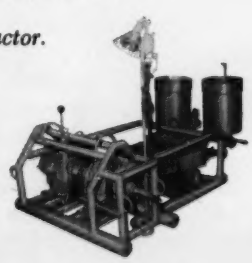

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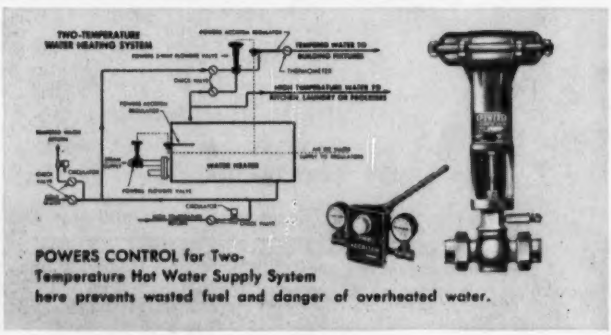
Above: Recovery room for efficient post operative care



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Roberto Rocca

– *Starts on front cover*

Ankara, Athens, Buenos Aires, Caracas, Mexico City, New York, Santiago de Chile, and Sao Paulo.

Roberto Rocca was drafted into the Italian Navy shortly after he completed his undergraduate work at the *Politecnico* (Institute of Technology) in Milan, in 1941. He spent his military career as an engineer in charge of the equipment on a submarine until the Armistice was signed with the Allies, in 1943. At the time of the Armistice, Rocca's submarine was docked in Genoa along with a number of other Italian warships of various kinds and in varying condition.

"We knew the Germans were going to be there before long. (And we were right. They got there within 12 hours). Ships in shape to travel immediately left for Allied territory. The rest were scuttled. I simply opened the valves on the submarine and left."

At the time, Agostino Rocca was general manager of Ansaldo, one of Italy's larger shipyards. He certified that his son was needed for a priority job, and thus avoided his re-drafting or his deportation by the German Army. Young Rocca, under cover of his mechanical draftsman's certificate, returned to Milan where he continued his studies at the Institute.

Some say you can deal with men without love, but that is not true. You can hammer iron without love, you can manufacture bricks without love, but you cannot deal with men without love. If you play with bees without love, you will injure them and injure yourself; and it is so with man.

Tolstoy

Throughout the remainder of World War II, the Rocca family lived in the countryside, which was occupied by partisans, although the Germans had control of Milan. Roberto and his father stayed in Milan but spent a few weekends in the country with the family. "We traveled on an old tandem bicycle. Although we never knew when the Germans would have the roads blocked, they never gave us, as civilians, much trouble."

Rocca was graduated from the *Politecnico* as a mechanical engineer, in July 1945, shortly after the end of the war. At this time Agostino Rocca was presented the problem of relocating Italian technicians, unemployed as a result of destruction or the shutdown of industries producing strategic materials. He decided to go into business himself and employ, as best he could, these wasting human resources. A number of his associates on former government-controlled industries agreed to join him in Techint. Young Rocca also brought some of his friends, who had been leading engineering students, into the firm.

"This combination of age and youth has worked extremely well," Roberto Rocca says. "Although Techint was established as a corporation, this initial brain-trust of senior and junior associates always has been operated on an informal basis – like a partnership, with key associates receiving their share of the profits. All of the principals who joined in at the beginning are still with the firm."

After Techint was formed, Rocca was awarded a fellowship, and later on a research-assistantship by the Department of Metallurgy at MIT. He studied at MIT for a few months in 1946, and for two years in 1948-49. He got his doctorate at the end of 1949, with a thesis on the thermodynamics of sulphur in iron and steel. He also has had a number of research papers published in the *AIME Journal of Metals, Revue de Metallurgie*, and *Metallurgia Italiana*.

"Studying at MIT and dedicating my spare time and vacations to Techint was hard work. I considered becoming a teacher and perhaps staying at MIT after I received my doctorate, but I had become so interested in Techint, I could not stay away from it permanently. At the same time, it was hard to leave Dr. John Chipman, head of the MIT Department of Metallurgy, since I feel that he influenced me and guided me more than anyone except my father."

The conditions that had made possible Techint's formation originally – the local availability of excess technical skills, and the deep economic depression – also made the support of a corporation on Italian earnings impossible. So the Roccas concentrated on foreign projects from the beginning.

Working in South America has resulted in an unusual but successful method of handling projects. Two seamless pipe mills, recently completed, illustrate the Techint approach.

From previous work, Agostino Rocca had ideas for the design of a seamless pipe mill. Having the design, he needed a client and a good location. It was decided Argentina would be a likely location, and South American investors were found. The investors, however, changed their minds. Techint did not give up but found the needed financial backing in Europe. Then Techint found that in South America they had to be more than designers, more than consulting engineers. No construction firms able to build a pipe mill could be found, so Techint accepted the responsibility for construction. A firm that thought of itself as engineers only, had become financers and builders as well.

"We prefer not to do construction on the same projects on which we have handled the design and

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supervision," Rocca explained. "For example, Techint handled design and supervision for the NATO pipelines in Italy, Portugal, Greece, and a portion of Turkey. We did no construction on that project. We prefer to be the consulting engineer only — but in some parts of the world you cannot do difficult engineering design without also doing the construction. No local contractors have the equipment or the experience to bid on the project."

The seamless pipe mill in Argentina led to a similar one in Veracruz, Mexico. This latest project, valued at $40 million, is almost twice the size of the Argentine plant and is capable of turning out 150,000 tons of 3″ to 16″ pipe annually.

On these projects it also was necessary for Techint to supply some sort of advisors for management of the completed plants — someone to train the unskilled local employees. A management division of Techint was established, but it also works independently of the design department. As an example of their management program, Techint was asked to provide a management team in Mexico, and supplied accordingly the key personnel and more than 20 men to train local executives, technical and administrative superintendents, and foremen.

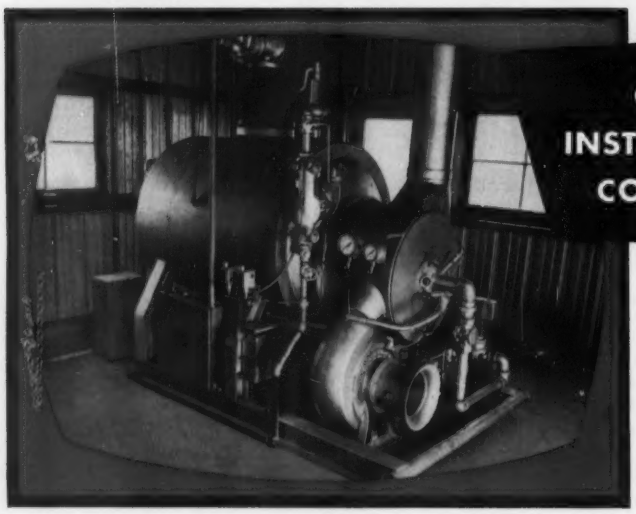
"One of our associates is one of the two heads of the management group who are directly responsible to the president of TAMSA, the pipe company. He is one of the four key executives who are on a joint payroll. The remainder are paid directly by TAMSA. And at the end of the contract, they will be welcome back to Techint, but they may remain with TAMSA, if they want to."

Techint, which now offers mechanical, electrical, civil, and metallurgical engineering, designed one of the first 400-kv transmission lines in Latin America. Three years ago, a 380,000-volt transmission line, more than 300-miles long, engineered by Techint, was completed from San Nicolas to Buenos Aires. The new 400,000-volt "El Chocon" system also has been entrusted to Techint.

Other Techint projects include a steel mill in Mexico, design of roads for the Syrian government, city planning in Bolivia, chemical plants in Chile, assistance and supervision of construction of American industrial plants in Italy and Argentina. A peculiar Techint project is the assistance to the Minister of Public Works in Haiti for carrying out their road maintenance program under a loan by the World Bank.

No Shortage of Engineers

Although the majority of Techint projects are outside Italy, Rocca is quite happy with Milan as permanent headquarters. "Italy," he says, "is a good



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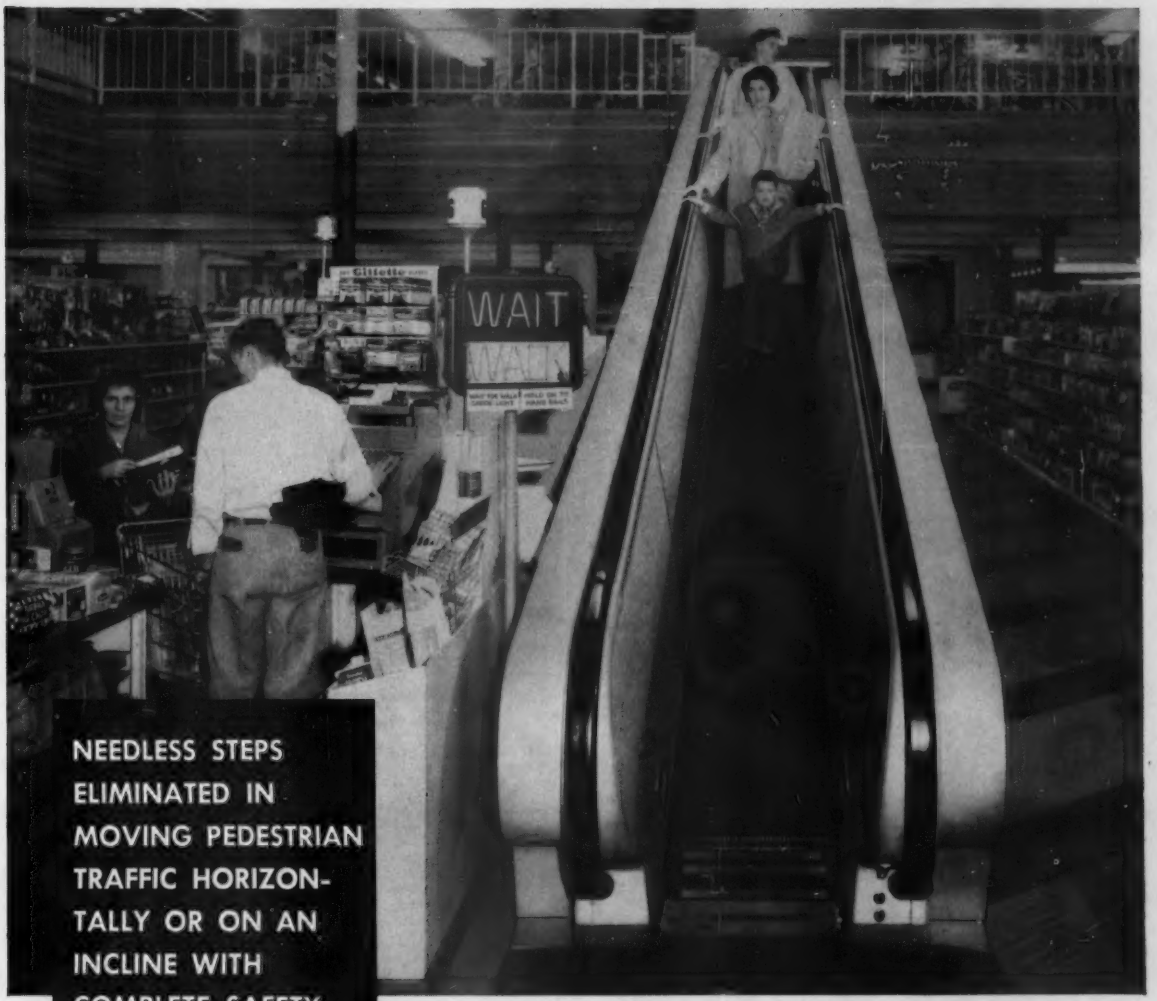

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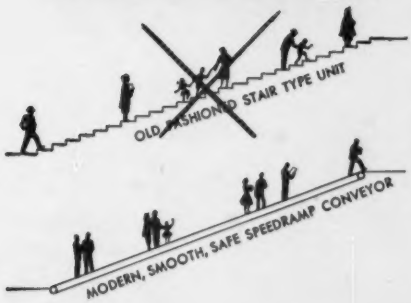

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source of engineers. We have a total staff of 500 technical men, which includes 150 engineers. And although the government and industry compete for the top students, we find the present trend is away from 'security' jobs. The government always gets a good slice of the engineering students, but they seem to get the slice on the bottom. We get the better ones.

"Italian engineers work out well on foreign projects, too. Most Italians speak more than one language, and the engineers learn a new language quickly when necessary.

"And the habits of the traveling Italian keep expenses below those of Americans. For instance, an American engineer working on a Turkish project probably would stay at the Istanbul Hilton and mix mostly with other Americans. An Italian engineer would prefer to pocket any of his per diem allowance possible, staying at one of the less expensive hotels."

Fee Practices

On the projects done on a percentage basis, Rocca said Techint fees are comparable to those charged by American firms – about 2.5 percent for design and 4 to 5 percent for supervision on large jobs.

On South American work, Techint tries to collect fees in local currency. This has not resulted in much of an exchange problem because Techint currently is reinvesting the money where earned if possible. This takes away some of the taint of "foreign engineering." Techint likes to hire native engineers in the various countries where they have offices, and have had considerable success with the men they have hired from the Latin American countries. Many of them hold high positions in Techint's international operations.

Rocca thinks South America offers good opportunities for consulting engineers. But he added a word of caution – "get the project before opening an office in a South American country."

Free Engineering

Italian consulting engineers have a real problem in "free engineering," a problem that is much more serious abroad than it is in the U.S., Rocca feels.

"We have a considerable amount of direct competition from companies that are not primarily engineers. For instance, in the power field both the large power companies and the manufacturers handle foreign design. And in nuclear work, the client is either the government or a large power company, and they either buy the plant as a package – equipment and all – or like the field so well they organize their own design departments."

The "free engineering" in Italy is so prevalent that there are few large consulting firms. Instead, government-controlled industries or large private industrial groups employ surplus personnel of their owners or tie engineering into other proposals. Their fees are seldom realistic. True engineering costs are hidden in the cost of equipment or non-professional services. The few large independent firms are mainly organized for foreign work or for carrying out projects in joint ventue with American engineering firms, thereby taking advantage of lower cost of draftsmen and engineers in Italy.

Society Memberships

With his quarters scattered in two hemispheres, Rocca travels an average of 60,000 miles a year and is therefore not too active in technical and professional organizations.

However, he is one of the founders of the Italian Association for Metallurgy, and keeps up his membership in the American Institute of Mining, Metallurgical, and Petroleum Engineers and in the British Iron and Steel Institute.

He also is a member of the Italian Order of Professional Engineers, an organization limited to consulting engineers. But Rocca said this consulting engineer group is not currently very active in Italy, and confines its activities to publishing a magazine of local laws and regulations. He feels that the coming of the Common Market, with Italy as a participant, may change this. ▲▲

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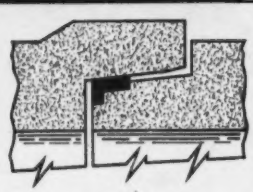

Type "C-P" TYLOX under full compression on offset concrete pipe.

"C-P" Gaskets are the true compression type, available in either rubber or neoprene, and withstand head pressures up to 50-feet. They may be installed at the job site, or the pipe manufacturer's plant. Specially compounded to resist sewerage and industrial waste acids, they never deteriorate. Write for brochure.

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KENT, OHIO *ORchard 3-9555*
CANADIAN: 10 Brussels St., New Toronto, Ontario

Indiana builds 1,500 new bridges... 1,087 miles of new Interstate Highways

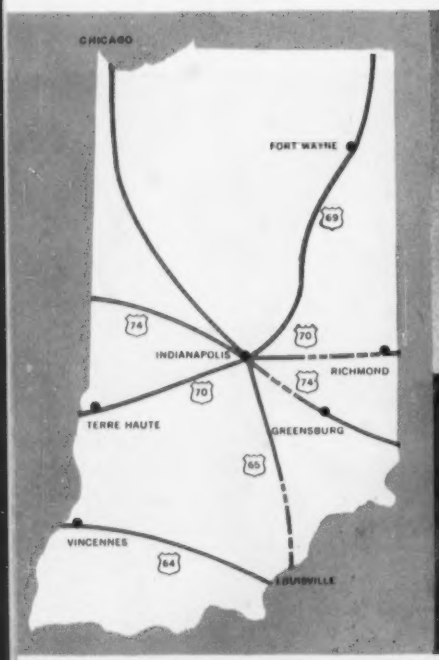
Upper left–USS Structural Steel, shown here in support of the bridge deck, is one of the most economical of all load-carrying materials. It has great strength, permits higher allowable working stresses, and is easily and quickly fabricated in all kinds of weather, substantially reducing construction costs.

Upper right–Tractor treads take a terrific beating day in and day out. USS Special Rolled Sections are produced to high-quality standards and can stand up to heavy punishment for a long time without replacement, cutting ultimate construction costs. In the background, USS TIGER BRAND Wire Rope lowers a crane load; USS DI-LOK Reinforcing Bars will aid in providing strong, stable support for a new bridge.

Left–More than two million tons of Blast Furnace Slag were used in constructing the western section of the Indiana East-West Toll Road. Air-cooled, crushed-and-screened slag was used as aggregate in the concrete column bents and pavement of this structural steel elevated roadway; and air-cooled, run-of-bank slag was used for erosion control along the banks of the Calumet River.

See inside

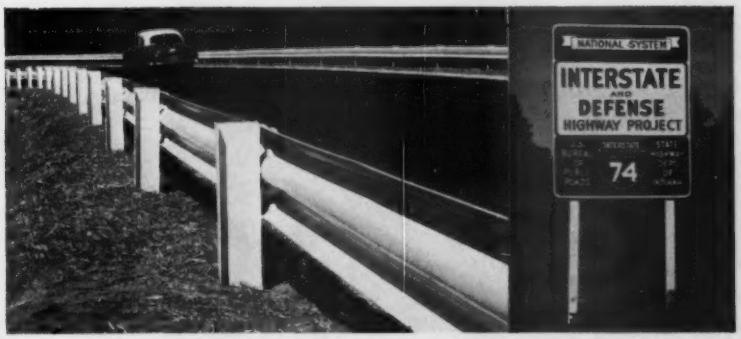
Indiana constructs new



This map shows the general location of Interstate Highways in Indiana. Dotted lines indicate completed highways. Almost all the main routes go into Indianapolis. It has more Interstate Roads leading into it than any other city in the U.S.

Interstate roads and bridges

Mammoth road-building machines like these must be strong. For strength plus lightweight that increases operating efficiency, strategic parts of this equipment are made with USS High-Strength Steels—USS MAN-TEN and USS TRI-TEN. Control cables are of dependable USS TIGER BRAND Wire Rope.



Highway safety begins with preliminary road design. From a safe, smooth surface (concrete made with UNIVERSAL ATLAS Cement) to strong, long-lasting AmBridge Guard Rail, USS can be your single source of supply. Included in the complete line of USS highway safety products are tubular poles for lights, galvanized steel guard cable, galvanized steel sheets, USS VITRENAMEL enameled sheets for signs, and CYCLONE Fence.

Left—Indiana's many bridges like the one here on Interstate Route 65 are built with a variety of highway products such as: USS Structural Steel, USS DI-LOK Concrete Reinforcing Bars, UNIVERSAL ATLAS Cement. USS Steel H-Piles support piers.

Write for the *free* 54-page booklet, "Keep Our Roads On the Go." You'll find all the United States Steel products and services that will help you cut costs and speed operations in highway construction. United States Steel, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

with help of products from U.S. Steel

Construction for the Interstate Highway Program is moving rapidly in Indiana. 1,087 miles of Interstate roads and 1,500 bridges are scheduled. Of these, 817 miles of new highways and 103 bridges are under development. More than 165 miles of new roads and 453 new bridges have already been completed or are under construction, not including the Indiana Toll Road. Over $80,575,000 is being spent on the Program this year. The work is under the direction of John Peters, Chairman, Indiana Highway Commission, and G. M. Foster, Executive Director of the Indiana Highway Department.

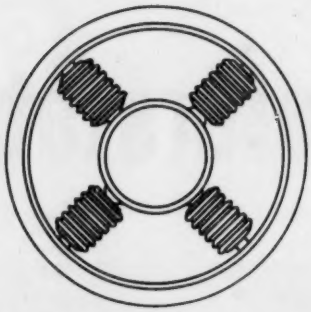
Many kinds of highway products are needed to build Indiana's roads . . . and U. S. Steel offers a *complete* line of these products: Structural carbon steel, high-strength and constructional alloy steels for bridges; steel H-piles, sheet piling and tubular piles for bridge foundations; drainage products; cements for all types of concrete construction; slag; reinforcing bars and welded wire fabric; wire rope, cable, tubing and special steels for construction equipment; fence, beam and cable guard rail, steel sheets for signs . . . and dozens more.

USS, ATLAS, CYCLONE, DI-LOK, MAN-TEN, TIGER BRAND, TRI-TEN, UNIVERSAL and VITRENAMEL are registered trademarks.

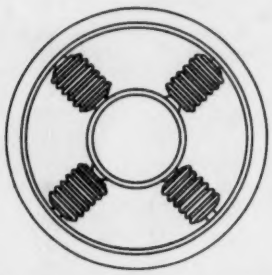
United States Steel

USS

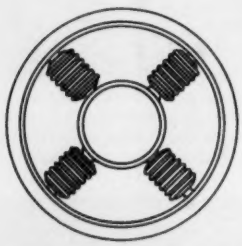
The highway market is served by United States Steel, Pittsburgh, Pa., and the following divisions: American Bridge Division, Pittsburgh, Pa., American Steel & Wire Division and Cyclone Fence Department, Cleveland, Ohio; Columbia-Geneva Steel Division, San Francisco, Calif.; Consolidated Western Steel Division, Los Angeles, Calif.; National Tube Division, Pittsburgh, Pa., Tennessee Coal & Iron Division, Fairfield, Ala.; Universal Atlas Cement Division, New York; United States Steel Supply Division, Steel Service Centers, Chicago, Illinois.



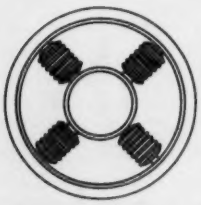
Standard Bus—Up to 90°C The AIEE standard, coupled with I-T-E quality construction—lowest losses.



High Temperature Bus—105°C Reduces conductor size by 15% with correspondingly lower cost—but with increased losses.



Forced-Air Cooled Bus Even smaller in size, with still lower material costs —still higher losses.



Liquid-Cooled Bus Minimum conductor size—highest losses.

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The Readers' Guide

Materials Handling

(page 103)

The materials handling equipment industry should be doing business at a $3 million a year rate in just a few years. Buried in that figure are a lot of dollars that should be going to consulting engineers in the form of fees for engineering services. While consulting engineers and materials handling equipment manufacturers have their differences, there is one complaint they share in common – there simply are not enough qualified consulting engineers willing to take on assignments in materials handling system design. This month's Special Report on materials handling highlights the attitudes and activities of a number of consultants and manufacturers. In addition, a prominent consultant specifically defines the proper role of the consultant. It is not an easy role, but it is one that can be of significance to the equipment manufacturer as well as the consultant. Both can benefit, and even more important – so can the client! To illustrate the breadth of the materials handling field, CONSULTING ENGINEER has selected a number of projects on which consulting engineers have been engaged. They range from the conventional to the extremely complex, but all are based on sound designs and engineering specifications written by a consulting engineer. How detailed the consultant's drawings and specifications must be is largely determined by the nature of the project, but they should be detailed enough so that the consultant can confidently assume the responsibility for system performance while the manufacturer is responsible for equipment performance.

Concrete's Fifth Ingredient

(page 98)

Many engineers fail to recognize that concrete admixtures are probably as old as cement itself. What is more important, their use is growing steadily, and the patent medicine atmosphere that surrounded their early promotion gradually is being replaced by sober engineering statements based on sound research. It is no longer claimed that admixtures can "make bad concrete good." However, it has been established that the quality of good concrete under certain job conditions can be better maintained by the use of proper admixtures. What is needed now are sound engineering specifications for admixtures. Their use should not be left up to the contractor or ready-mix plant operator. Rather, they should be used as a "fifth ingredient" of concrete, and specified when and as needed by the consulting engineer.

Consultants and the Common Market

(page 136)

Anyone at all familiar with the private practice of engineering in Europe knows of the difficulties an engineer in one country encounters when he tries to get a project in another. If the engineer is a nationally known expert in some rare and unusual specialty, it is not too bad. The world-renowned are accepted anywhere for brief visits, but the average consulting engineer engaged in design and supervision of construction has not now much of a chance outside his own native land; certainly not on the design of schools, office buildings, hospitals, and the other bread-and-butter projects. It always has been difficult, in fact, for the authorities or even the practitioners in the several nations to decide what it takes to make an engineer – officially. All that is going to be changed – for the six common market countries, anyway. They now have committees at work to draw up agreements that will provide for free traffic of engineering services across borders, for a single list of qualifications, and a common registration. This should give the profession in Europe a real boost. See the excellent report prepared by The Economist Intelligence Unit Ltd.

Just 75 years ago, heating was about as unpredictable as the weather, as temperatures alternated between shivery low and smother-high. Then a Wisconsin schoolteacher named Johnson decided to do something about classroom comfort and thereby launched a new industry!

The Story of the Thermostat

Actually this is the story of a symbol . . . the symbol of an industry that has brought comfort, safety, better health, and efficient working conditions to people all over the world.

. . . In a specially equipped manufacturing plant, delicate missile parts and components, with micro-inch tolerances, must be made under temperature and humidity conditions that never vary. At every step in their manufacture, modern pneumatic controls assure error-free regulation of the thermal environment.

. . . In a hospital, surgeons perform a lifesaving operation. Accurate pneumatic controls maintain the temperature and humidity at preselected levels to conserve the patient's strength during surgery.

. . . Every morning of the school year, millions of students sit down to study and learn in comfortably heated and ventilated or even air-conditioned classrooms. To help provide this ideal environment, the great majority of schools and colleges everywhere depend on precision pneumatic control systems.

. . . Far at sea, one of the nation's deadly new submarines cruises undetected, an elusive, power-laden sentry of the "Silent Service." Her crew lives and works in comfort and safety — in a climate precisely regulated by a pneumatic control system.

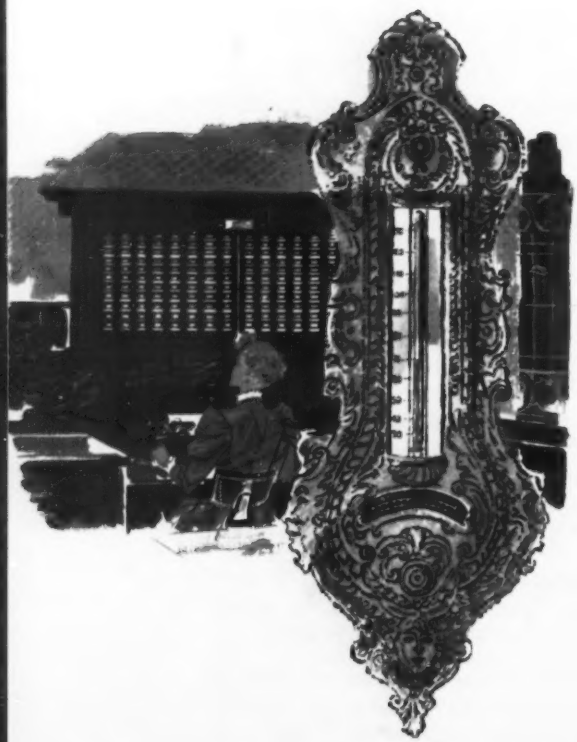
. . . Across the continent, pneumatic controls assure safe air conditions in the highly critical processing areas of an atomic energy facility. Pneumatic controllers of extreme sensitivity operate constantly to assure safe disposal of waste air and prevent the escape of contamination.

These are but a few examples of the ways in which modern pneumatic controls play a vital part in regulating the environment in which we live and work — helping to create made-to-order indoor climate for every purpose, controlling temperatures and humidities to a degree undreamed of when Professor Warren S. Johnson invented the first automatic temperature control system back in the 1880's.

Inventor at Work

Though he was probably unaware of the fact at the time, Professor Johnson became the founder of the automatic temperature control industry when he devised a practical way to eliminate the problem of classroom temperatures that seemed to zigzag forever between shiver and swelter.

His first attempt at control — the "annunciator" system — merely called the janitor's attention to overheating, or lack of heat, by ringing a bell in the furnace room. The janitor would then open or close the classroom dampers, as required.



But this land-based version of a ship's telegraph soon gave way to an all-electric method, utilizing a thermostat in each room that would open and close the dampers automatically. And so, the first system of automatic heat regulation was born.

The Electro-Pneumatic System

Intrigued with the possibilities of his long-awaited discoveries, Professor Johnson in 1883 left his post at Whitewater, Wisconsin, State College and came to Milwaukee to devote full time to refining and marketing the Johnson System.

His second major achievement, an electro-pneumatic control system, occurred almost at once. By successfully uniting the forces of *electricity*, for thermostat operation, and *compressed air*, for valve and damper operation, he developed a far more dependable and fully automatic control system. Finally he was ready to go out and revolutionize the comfort standards of the world. In 1885, he incorporated the business which today bears his name.

With branches established in Chicago, St. Louis, and New York, the Johnson thermostat on the wall soon became a familiar sight in the leading buildings of the day. Schools, prominent residences, and small business buildings were first to enjoy the comforts and economies of automatic control. They were followed closely by colleges, hospitals, public buildings, offices, stores, and industrial plants.

From Mikado to Czar

Acceptance grew, markets widened. The fame of automatic controls traveled fast and far. Before 1890, the city of Berlin, Prussia, had written a report about the efficiency of its Johnson System. Later, the palace of the Mikado in Japan was equipped with Johnson Control. The King of Spain and other European royalty became Johnson customers. A special installation was made in the Kremlin in Moscow!

Single Responsibility

Professor Johnson had the foresight to realize that the key to his success depended upon the *proper application* of his controls. Accordingly, he determined, from the outset, that his company should *never sell devices*, but should sell a *principle of control*. This meant that each system would have to be planned, manufactured, installed, and serviced *by Johnson* to meet the exact needs of the individual building.

Over the years, this policy of complete responsibility by a single specialized organization has insured owner satisfaction and saved untold millions of dollars for Johnson customers.

Carrying out this policy has also resulted in the closest possible working relationship between the Johnson organization and the nation's consulting engineers and architects, in a joint effort to provide ever better control of thermal conditions.

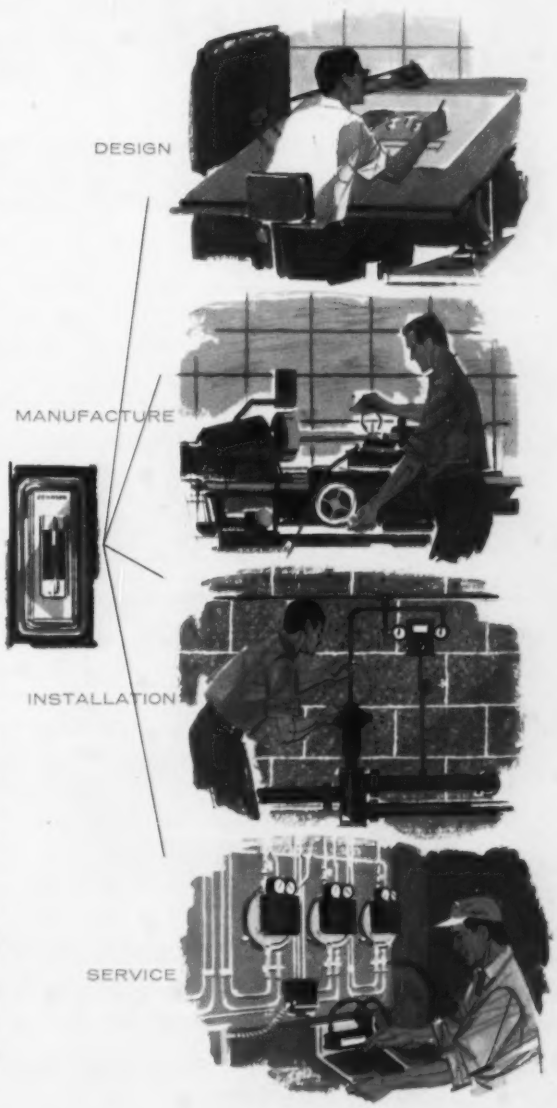
Many Johnson "Firsts"

The history of the thermostat and the Johnson Service Company coincides with the period when other pioneers were busy introducing innovations in heating, cooling, and ventilating methods and in developing full-scale air conditioning. Working closely with the research staffs of these manufacturers, Johnson engineers were able to supply the most effective controls for every new development in basic equipment. This cooperation has continued and flourished to the present.

Over the years, the Johnson Service Company has been the source of a never-ending flow of new ideas, which have included virtually all of the key developments in the field of automatic temperature control!

By far the most important was the all-pneumatic control system, perfected in the 1890's and still the standard everywhere. Others include the all-metal thermostat, the famous *Dual* or day-night thermostat, the heating-cooling thermostat, summer-winter thermostats, the airstream thermostat, master-submaster thermostats, supersensitive gradual-acting thermostats, and powerful piston damper operators.

Another famous development was the Humidostat or humidity regulator. And, of course, the Comfostat, an exclusive Johnson instrument that controls room temperatures in relation to humidity conditions. The popular pneumatic control center, for centralized supervision and control of modern air-conditioning systems, also was first perfected by Johnson.



Uninterrupted Progress

As the concept of controlled environment gathered momentum, so did Johnson. Important "firsts" became routine jobs, as the industry looked to Johnson for the answers to new control problems. From the simple comfort needs of the buildings of the 80's and 90's, to the history-making demands of the first scientifically air-conditioned building, down to the most complex requirements of today's commercial and industrial buildings, Johnson has been the leader in the pneumatic temperature control field.

Today, wherever you go, you'll find the important buildings are equipped with Johnson Control. From the fabulous Fontainebleau Hotel to the mammoth Merchandise Mart to the famous UN Secretariat Building . . . in schools, hospitals, sprawling defense plants, research laboratories, vital military installations, shopping centers, in buildings of *every* size and type and in ships at sea . . . there are temperature and air-conditioning control systems by Johnson.

Johnson Today...and Tomorrow

To make certain that each installation performs up to expectations, Johnson backs its engineers with the most complete line of pneumatic temperature, humidity, and pressure control equipment in the industry.

To serve you most efficiently both before and *after* a sale, Johnson maintains the largest and most experienced field organization in the industry, with 107 completely staffed branch offices in the United States and Canada, plus full-time, factory-trained installation and service mechanics in over 200 other cities.

This is by no means the end of the story of the thermostat. For against this unmatched background of innovation, experience, and service, Johnson's never-ending search for new and better controls will inevitably lead to dramatic new ideas in the years ahead. As the day of completely air-conditioned cities approaches and as new and unprecedented demands for precision controls evolve, the forward-thinking Johnson organization will always be ready with the right answers.

The Johnson research and development staff and facilities have been expanded three times in the past four years. And final plans for the next major expansion are already underway! In the future then, as in the past, you can continue to look to Johnson for the world's finest controls!

Johnson Service Company, Milwaukee 1, Wisconsin. In Canada: Johnson Controls Ltd., Toronto 16, Ontario.

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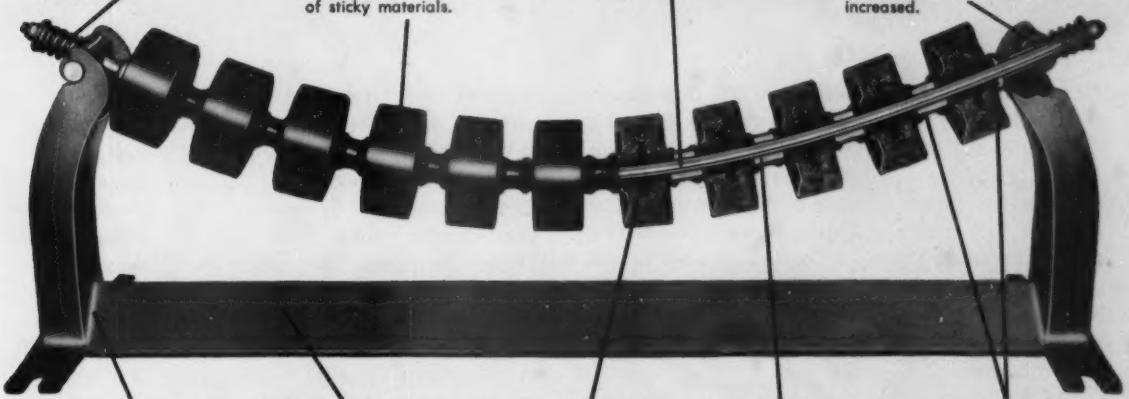

WELDED STEEL FRAMES—All steel, deeply-ribbed end stands accurately jig-welded to the stiff angle cross-member.

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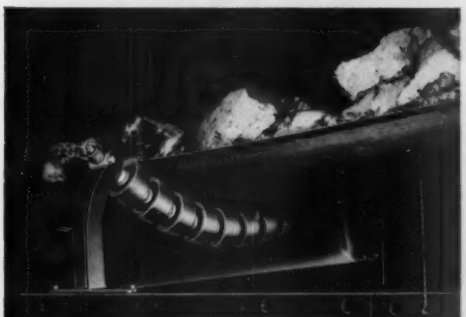

Closeup of a 30" S-A FLEXIROLL Catenary Idler in operation on belt conveyor handling coal. There is no fire risk with the FLEXIROLL and material breakage is reduced to a minimum.

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- Increases belt training and greatly reduces belt wear.
- Both idler and stand self cleaning—eliminate material build-up.
- No metal to metal contact—flexing of idler prevents dust build-up, eliminating fire risk.
- Flexing action reduces material breakage, prevents spillage.
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- Idlers can be changed without stopping the belt.
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- Catenary suspension of the FLEXIROLL carrier supports the belt in a natural arc.

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From the Editor's

Tranquil Tower

Dinosaur Tracks in The Garden

DURING the past several weeks we had occasion to read and review some of the history of engineering societies of the United States. In the 20 years from 1915 to 1935, we noted, the American Association of Engineers kept appearing from the wings, popping up from the pit, sliding down from above, and at times coming close to taking over center stage. In 1922 it had 22,000 members to ASCE's 9000, but during the depression its membership slipped, and, according to some critics, it made an exit to the left.

The American Association of Engineers was not a technical society. It was established to deal with "the human side of engineering" — ethics, income, legislation, registration, education, and related matters. It looked upon itself as the logical unity organization. While strongly favoring registration, it did not require it for membership, insisting that this should not be a qualification until all engineers were forced by law to register in order to practice their profession. It is interesting to note how closely its purposes parallel those of the National Society of Professional Engineers. In fact, some of its most active members of the '20s were among the founders and early promoters of NSPE. (Dr. Steinman was president of AAE in 1925-26.) Yet NSPE rose and flourished during the '30s and '40s while the American Association went into decline.

At this distance it is impossible to point, accurately, to all the reasons for the success of NSPE and the failure of AAE. The American Association, some may remember, had been formed, in 1915, as a protest against the stodgy conservatism of the prewar American Society of Civil Engineers, in which the young men claimed they could find no one interested in their problems. But by 1935, most of these young Turks were middle-aged, and they were getting pretty stodgy themselves. Most who had the money to belong to any society found that they felt more at home back in the dingy marble foyer at 39 West 39th Street. Others, who perhaps still preferred AAE simply could not afford to pay the dues. Yet, as a big society, AAE had a heavy office overhead to carry, and mere mass meant it had a momentum to maintain. In a spirit of desperation and misdirection, it got involved in some labor-management disputes that it should have avoided. But times were tough. Its appearances before the U.S. Railway Wage Board in behalf of railway technicians and engineers, and before the Navy speaking for the Navy's technical men in wage disputes, hurt the Association in the eyes of some of its more affluent members.

In contrast, NSPE was a depression baby. It had low overhead and the enthusiasm of the very young. It wisely restricted its membership to registered engineers, which besides other obvious advantages, offered a legitimate snob appeal at low cost. It kept its nose clean in labor relations; so clean that it was easy to answer the shrill chorus that screamed, "D.B. is starting a union for registered engineers."

Whatever the other reasons, NSPE blossomed while the American Association faded away. It faded so far and so fast that by 1940 it was seldom heard of. Rare, indeed, is the engineer graduated in the '50s who has heard of AAE.

It was, therefore, with the excusable awe of one finding distinct dinosaur tracks in the garden that we read, in one morning's mail, that "William B. Keller had been elected president of the 100-member Phoenix Chapter of the American Association of Engineers." This was so hard to believe that we contacted Mr. Keller just to make sure that there was not some error in the news release. There was no error. There *is* a 100-member Phoenix Chapter of the American Association of Engineers. It operates as a luncheon club, meeting every two weeks. Membership is composed largely of the older engineers and their architect friends. No one pays much attention to registration or legislation, and

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CITY AND STATE _____

certainly not to the economic problems of the profession. It is about as nonpolitical and nonaggressive as a luncheon club can be, and its sole objective is to provide a good lunch with an interesting speaker afterward. If someone were to point out that this is the group that pulled out of ASCE in 1915 because "the Founder Societies are made up of old men, unwilling to interest themselves in the problems of young engineers," these Phoenix Chapter members would look at you in disbelief — except perhaps for one or two of the elder elders like Vic Householder, who remembers when the American Association was young, dedicated, and out to make a new kind of world.

The strangest aspect of the Phoenix Chapter is that its members continue, for reasons hard to understand, to pay dues to the national office in order that they may have a luncheon club in Phoenix. These dues ($15 or $20 per member depending on grade) go to the American Association of Engineers, 8 South Michigan Avenue, Chicago. If one visits that office one will find the director of AAE, Herman Alexander Wagner; born Grahamtown, New Zealand, April 17, 1864 (that is correct, MDCCCLXIV), E.M. (mining) Freiberg, 1888, Ph.D. Heidleberg, 1889. With him is his assistant, M. E. McIver, the lady secretary-treasurer. She, too, has been with AAE for some time; a publication of the Association dated 1929 shows her as secretary.

Even more astounding than the national office and the "100-member Phoenix Chapter" is the existence, according to Miss McIver, of "25 or so other chapters and 10 or 12 student chapters," though this may be just a wee bit of an exaggeration. On top of that, the American Association of Engineers is one of the member organizations of the National Council of State Boards of Engineering Examiners, and it actually sends representatives to the meetings of that group. When NCSBEE met in Atlanta, in 1957, the AAE was represented by Charles E. Tweedle, president of the Birdsley Flour and Feed Mills, Macon, Georgia. In 1958 the Council met in Milwaukee, and AAE's representative was Dr. Max von Berlighingen, of Herbst, Jacoby & Herbst.

Moreover, the American Association is listed in the front of *Who's Who in Engineering* right along with all the other national engineering organizations. And the *Encyclopedia of American Associations* shows it (immediately above Engineers Council for Professional Development) as having 4990 members and a staff of five.

The current president, incidentally, is Patrick J. Lucey, La Grange, Illinois; vice president is George Havas, of Oakland, California. Six other members of the board of directors are listed in *Professional Engineer*, the Association's 24-page pocket size quarterly publication.

Last chance! Anyone for unity? ▲▲

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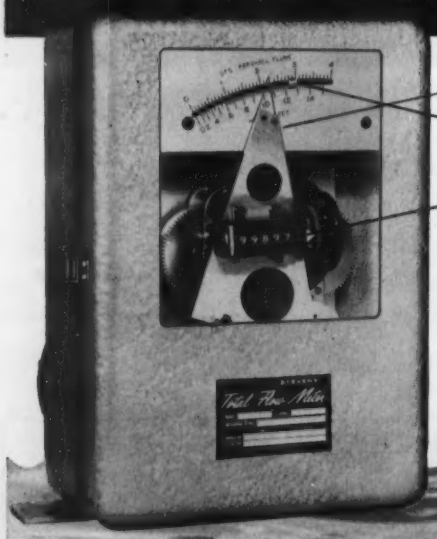

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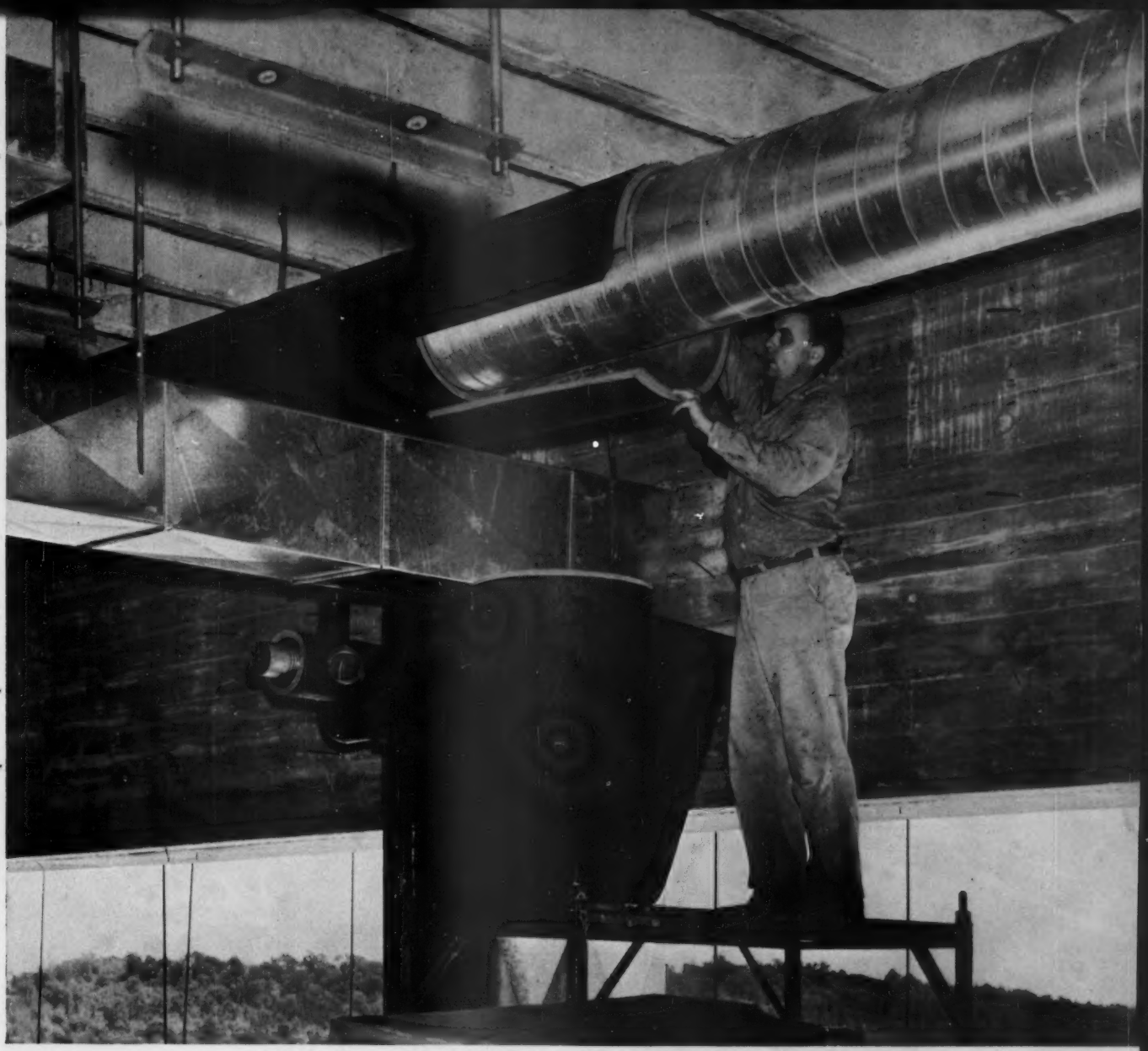

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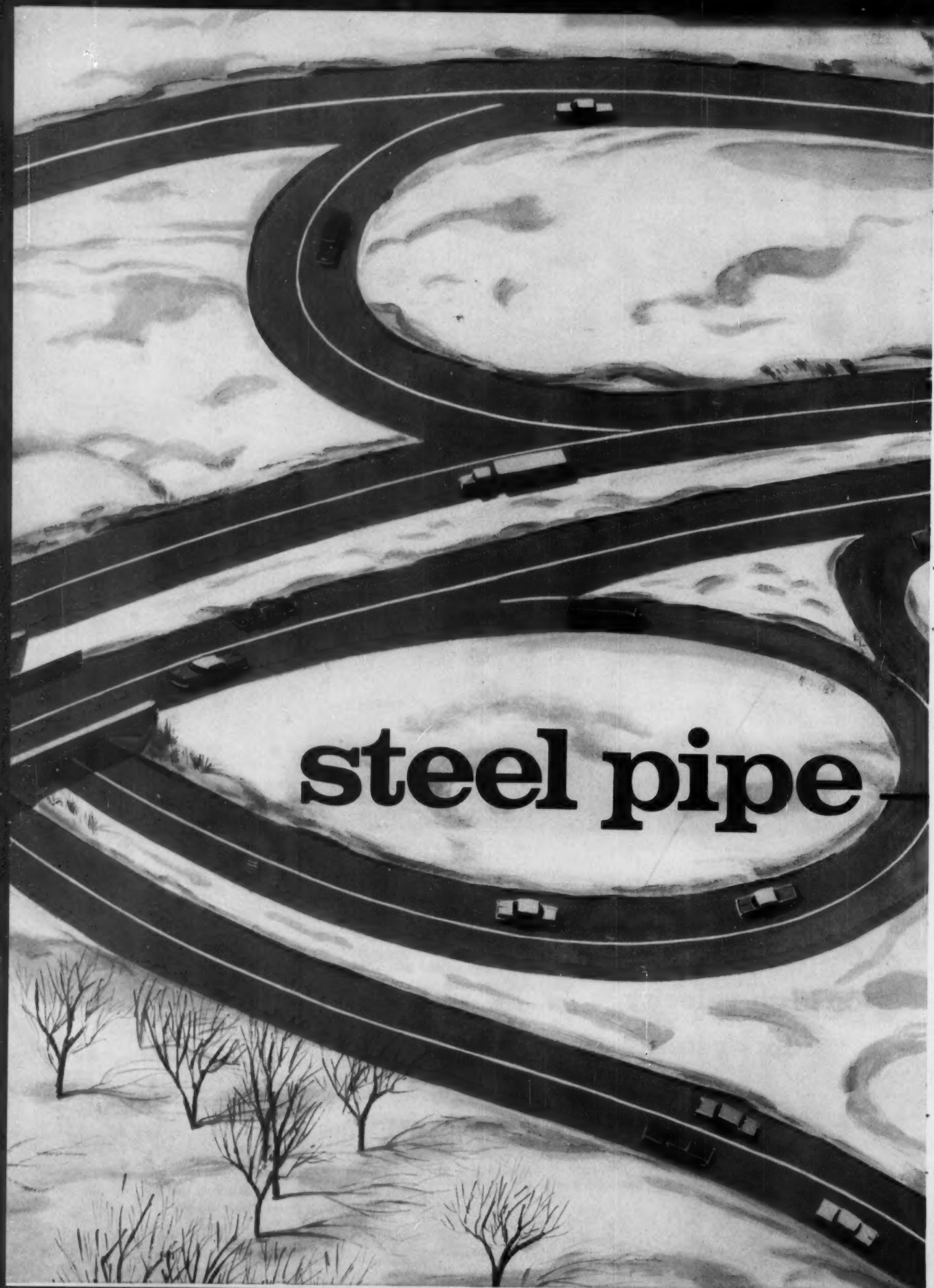
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Readers' Comment

Engineering Cost vs. Quality

Sir:

I want to congratulate you on your staff article in your March issue on engineering costs in state highway departments.

There are some remarks that I would like to make about the arguments between the state highway engineers and the consultants as to who can perform the work more economically. I think we are the only profession that boasts about how economically we can accomplish our services. Actually, a review of some of our structures four or five years after they were built might indicate that not enough time or money had been spent on the engineering. It seems to me that the public is entitled to the best structures possible under present day conditions, and that the basis of getting these structures is complete studies and a thorough analysis of the problems involved. The usual manner of cheapening engineering costs such as the prolific use of standard plans and skimping on the design studies which produce cheap engineering costs are not to the benefit of the public.

The part of the world that is free has had no trouble in outproducing the socialized part of this world. Where we have tried socialism on this continent on the state level it has, in spite of government support, been unable to compete with private industry. There is no doubt that if the state highway designs were accomplished with private engineering firms the competition induced among the firms doing this work would provide the public with much more interesting highways and highway structures. The theory that government operation of any profession or business reduces the overhead and sales cost has been shown to be a fallacy in every attempt of this nature that has been made. Professor Parkinson summed it up very well in his law which is worthwhile quoting here. "Any government bureau increases at a certain fixed rate annually with no increase of the work load, if any."

Harry R. Powell
Harry R. Powell and Associates
Seattle, Washington

Likes the Change

Sir:

I would like to compliment you on the "Reporting the New Projects" section. I believe this is a much more interesting presentation than the method of simply listing the projects that you used last year.

Your magazine is excellent and says many things consulting engineers feel in their hearts. I hope for your continued success.

Billy L. Stephenson
Acrey & Stephenson
Dallas, Texas

Commercial Data Processing

Sir:

Articles which appeared in recent issues of CONSULTING ENGINEER dealing with electronic computers and their role in the consultant's office, implied either a purchase or the rental of electronic equipment by the firm. This procedure, to be economical, practically eliminates the use of computers by firms having less than 75 design engineers.

Recently I wrote and coded a program for the IBM 650 electronic computer for the engineering office with which I am associated. Our office has only seven engineers. In addition to the time taken to code the program, the cost of the program was approximately $280. Further, it was estimated that the cost of the program was recovered during the first application, and any subsequent applications would practically be free, involving only the cost of computations.

In order to achieve this, I carefully planned the flow chart for the problem, and had other engineers in the office review it and offer their suggestions. After the flow chart was finalized (a process which requires time and thought), it was finally coded in FOR-TRANSIT – a coding system compatible with many IBM machines. After the coding was completed the program was given to a commercial data processing center for assembly and computation of trial runs on a fixed fee basis. It was agreed that any changes would be treated as extras, and any faulty results that could be traced to other than the flow chart would be amended by the data processing center at no extra cost, until the program was accepted. We agreed to debug the program, and for this we prepared sample cases that would pass through all the branches of the program. This division of responsibility was the main factor in the success of our experiment.

I feel that any consulting office should have at its disposal an arsenal of carefully planned programs

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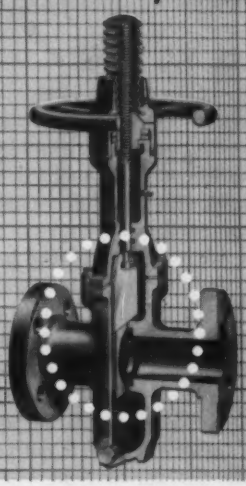

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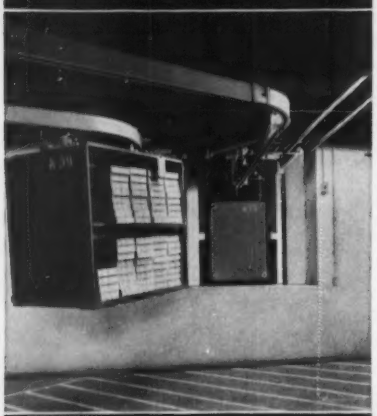

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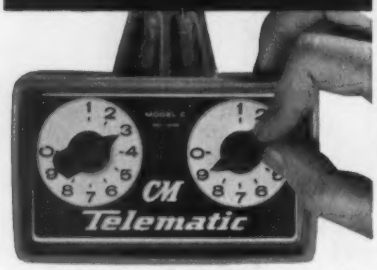

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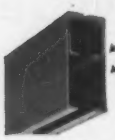

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that will alleviate the drudgery of computation. Experience indicates that, to be useful, a program must be developed by the office for which it is intended. It is doubtful if any program written by one office for its own use, could be successfully used by personnel in a different office, not familiar with the limitations imposed on the program by the original author. For this reason, "canned programs" are useless, except when they deal with standard mathematical manipulations such as matrix inversions, solution of simultaneous equations, and functions subroutines.

Saby Eliachar
Consulting Engineer
Daly City, California

Questionable Theory . . .

Sir:

Sometimes, fallacious, arguments are adduced in support of engineering innovations which experiments show to be of great merit. The fact that such arguments are incorrect does not diminish the value of the engineering procedure or design. However, it tends to obscure the fundamental nature of the behavior and is apt to result in misdirection of effort in attempts to improve performance. Substitution of correct and valid arguments is therefore desirable.

I believe that this is the case with the two-way prestressed concrete pavements described by Dr. Lev Zetlin in his article "A New Way to Pretension Prestressed Pavement," which appeared in your February 1960 issue. There seems to be little question but that two-way prestressed slabs should be able to withstand greater lateral loadings than one-way prestressed slabs. However, I think Dr. Zetlin's explanation requires revision.

The Mohr theory of failure says that "failure" takes place when a possible (normal stress — shear stress) point falls outside the Mohr envelope. All such possible points for a given state of stress are commonly thought of as lying inside the so-called Mohr's circle. However, nature is three dimensional, and possible points lie inside the largest and outside the two smaller circles which can be drawn with their centers on the normal-stress axis and with their circumferences passing through the *three* principal stresses. As the author points out, stresses normal to the plane of the slab are generally insignificant — but this is in one of the principal directions, so that one of the principal stresses is (very nearly) zero. If the other two principal stresses are compressive, as would result from two-way prestressing, the largest Mohr's circle goes between the origin (zero normal stress) and the larger of the two compressive stresses. (Interestingly enough, Mohr's failure theory attaches no importance to the intermediate principal stress, and this fact is thought by some to represent a fundamental defect in the Mohr theory.)

Briefly, the *most favorable* situation that can be obtained is that represented by the author's Fig. 1b. Fig. 1a is not attainable.

Why then is it that the two-way stressing is truly advantageous? It is simply that under load, the slab bends and the fibers lying in the plane of the slab and on the convex side would be placed in tension moving the governing Mohr's circle more toward the left (tension side) if it were not for the ameliorating effect of the compressive prestress. Two-way prestress helps assure that the situation shown in the author's Fig. 1b is not worsened when the slab is bent.

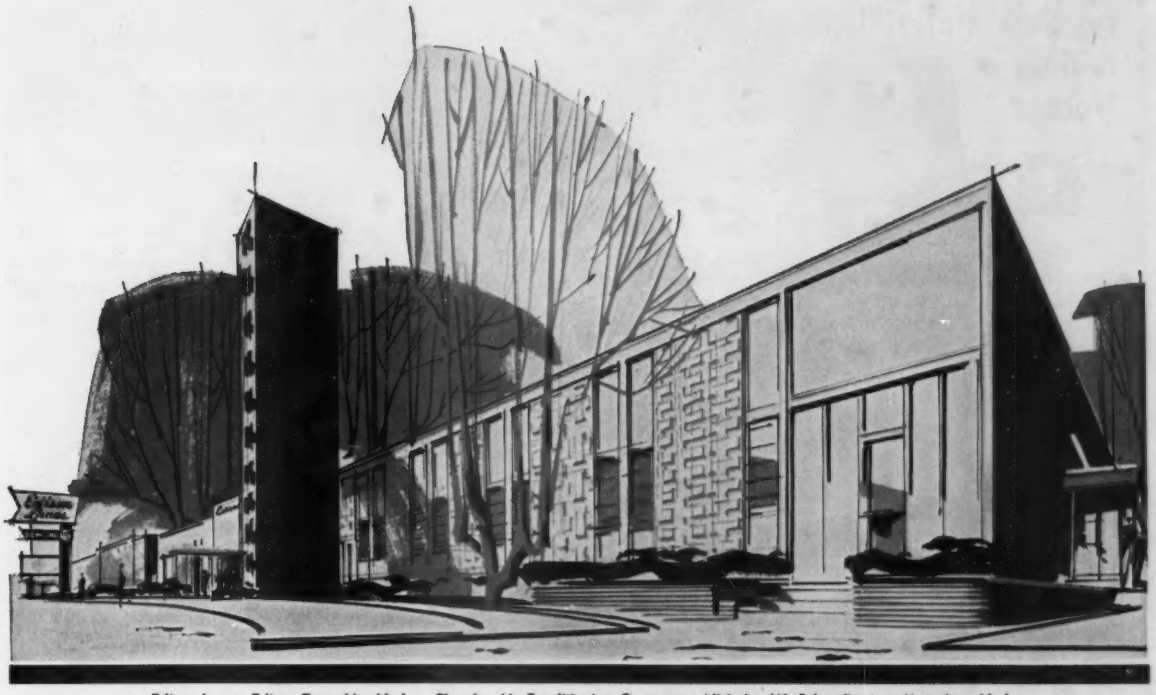
John E. Brock
Consulting Mechanical Engineer
Pebble Beach, California

But Good Practice!

Sir:

John E. Brock's comment is welcome, although it has no bearing on the main subject matter of the paper. The purpose of the paper was to demonstrate an easy new method to *pretension* prestressed

Climate by Chrysler



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pavements (rather than to post-tension), and a method to impart continuity to long prestressed pavements, sections of which have been prestressed individually first. That pavements must be prestressed in two directions is a recognized fact.

I do not contest Mr. Brock's comment on the minor issue relative to the subject matter in the paper, that of Mohr's rupture envelope. It is true that Mohr's rupture envelope considers only the largest and the smallest principal stresses and disregards the median principal stress. It was in consideration of this fact that the paper mentioned the normal stresses to the pavement. I would like, therefore, to take exception to the introductory general statement that "sometimes fallacious arguments are adduced. . ." It was not the purpose of the paper to bring out the Mohr rupture theory, and it was assumed that the readers of the article would be sufficiently familiar with Mohr's rupture envelope to judge its application to the problem discussed in the paper. Had a discussion on Mohr's rupture envelope been expanded in the paper, it would have clouded the main issue. Incidentally, Mr. Brock's second sentence in the third paragraph is not clear. He states that all possible "failure" points for a given state of stress fall inside a Mohr's circle. Mohr's circle, as such, represents only a state of stress and is not related to failure. Also, a given state of stress is represented by points on the circumference of the circle and not inside the circle.

Investigating a stressed point in a material one has to know the actual stresses to which the point is subjected on the one hand, and the strength of that point to resist the induced stresses on the other. In a pavement these stresses (due to bending, shrinkage, etc.) all occur in the plane of the pavement. Also, any cracking that would occur in the pavement would be along the plane perpendicular to the pavement. Since these are established facts, the application of Mohr's rupture theory, in a manner shown in the paper, holds. I grant that it could have been demonstrated that two-way prestressing is beneficial to the pavement by a discussion of plane stresses rather than by the introduction of Mohr's rupture envelope. Mohr's rupture envelope was introduced in the paper in the hope of *condensing* the discussion on the induced stress distribution and resistance of the pavement to these induced stresses.

I hope that Mr. Brock will concur with me that the introduction of Mohr's rupture envelope has been harmless to the main issue of the paper.

Lev Zetlin
Consulting Engineer
New York, New York

Impression of Japan

Sir:

Readers might be interested in a few recent observations of mine in Japan. For six weeks during the latter part of 1959 I held a series of seminars for 21 Japanese consultants in Tokyo. During my non-lecture time I visited 12 Japanese factories and counseled executives and engineers in the presence of Japanese consultants.

Despite the high efficiency of some of these factories I was surprised at the eagerness of these executives and engineers. They kept pressing me for more and more suggestions, noting these off-the-cuff ideas on paper. This eagerness was in sharp contrast to the attitude of some of my American clients who, occasionally, sit back and dare me to tell them anything new (reminding me of an old adage, "Man is the only animal that fights to stay in a rut").

There is considerable paternalism in Japanese companies. Once a person is hired, an employer assumes a moral obligation to look after him (her) up to the age 55 (when he retires, usually on a modest pension). If a worker does not make good on one job,

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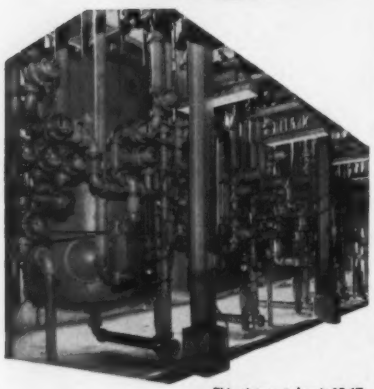

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he is tried on another job because an employer knows that it is difficult for a Japanese worker to secure employment elsewhere. Thus, a round peg in a square hole might end up as a handy man around a factory (or around an executive's home). This paternalism, in many cases, goes to the point of matchmaking for unmarried workers; and whenever an employee gets married, he (she) gets two weeks of honeymoon vacation (with pay). Wages are a function of need and length of service; thus a man with four children receives more money than a man with two children; and a man with 10 years of service receives more wages than a man with only five years of service.

Unions are well entrenched in most factories employing upwards of 100 people. The chief bone of contention is the semiannual bonus which frequently amounts to 20 to 40 percent of the base pay but is unrelated to efficiency, profits, or to anything else. Twice a year the union "puts the bite" on management for more bonus — "or else." Incidentally, Japanese foremen are members of the union and often do production work. But they do not have the "savvy" that American foremen have.

The intense desire of the Japanese to forge ahead despite tremendous odds took amusing twists at times. A Japanese consultant said (in deliberate English), "This factory is three years old." There followed a long pause and some muttering; then in a clear voice came this: "*are* three years old." Some of my little used American expressions did not stop my eager interpreters for long. Thus, my use of "Caesar's wife must be above suspicion," came out as a Japanese proverb, "An honest man will not tie his shoes when walking through a cucumber patch."

Most of the Japanese people are fond of America and Americans. Indeed, the Japanese are among the best friends we have in the world today — and they will remain our friends for many decades to come.

Harold R. Nissley, P.E.
Cleveland Heights, Ohio

Weather Forecast

Sir:

I have noted that you did not carry the Krick Weather Forecast in your first three issues this year, and I fear you have given up this item.

I have looked forward in the past to this item as it was of quite some value to me, and, I believe, to many other engineers.

I hope that you may be able to have the weather forecast run again in later issues.

Clyde K. Fisk, P.E.
Middlesex, New Jersey

Calendar Correction

Sir:

Because of the special interest so many consulting engineers have in the Design Engineering Show and Conference, I thought you might wish to correct an error or two in your Consulting Engineers' Calendar as it appeared in your March issue.

The show and conference are separate events, although they are held on the same days and in the same place. The Design Engineering Show is produced by Clapp & Poliak, Inc., a New York exposition management firm, while the Design Engineering Conference is sponsored by the machine design division of the American Society of Mechanical Engineers.

Both events will take place at the Coliseum in New York, May 23 through 26. Consulting engineers who register for the conference will be issued a badge of admission for both events. Those who do not wish to register for the conference may register for the show only. There can be little doubt that the joint events are among the most important on the consulting engineers' calendar.

Ed Greif
Banner & Greif
New York, New York

JOB REPORT: *NELSON Stud Shear Connectors in Composite Construction*

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Look into the advantages of composite construction for *your* next job. Call in your local Nelson field representative, or write for "The Case For Composite Construction". Nelson Stud Welding Division, GREGORY INDUSTRIES, INC., Dept. 14, Lorain, Ohio.

NELSON Stud Shear Connectors *were used on this project because (1) they do not cause distortion as do other types of hand-welded shear connectors, (2) greater versatility in connector placement was obtained and (3) the placing of reinforcing steel was simplified.*

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Telephone permits private, two-way communication.
Wall speaker provides for general announcements, special events, emergency instructions, etc.
Wiring is in same conduit as clock and program system.

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IMPRESSIVE INSTALLATION SAVINGS—All basic wiring runs in the *same conduit* as the school's clock and program system ... effecting additional important savings on installation.

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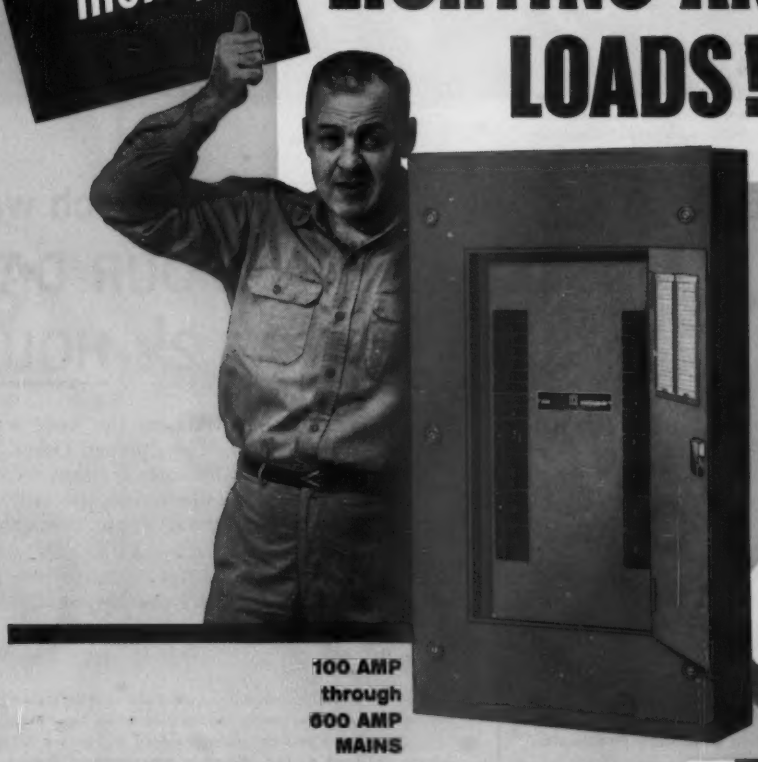

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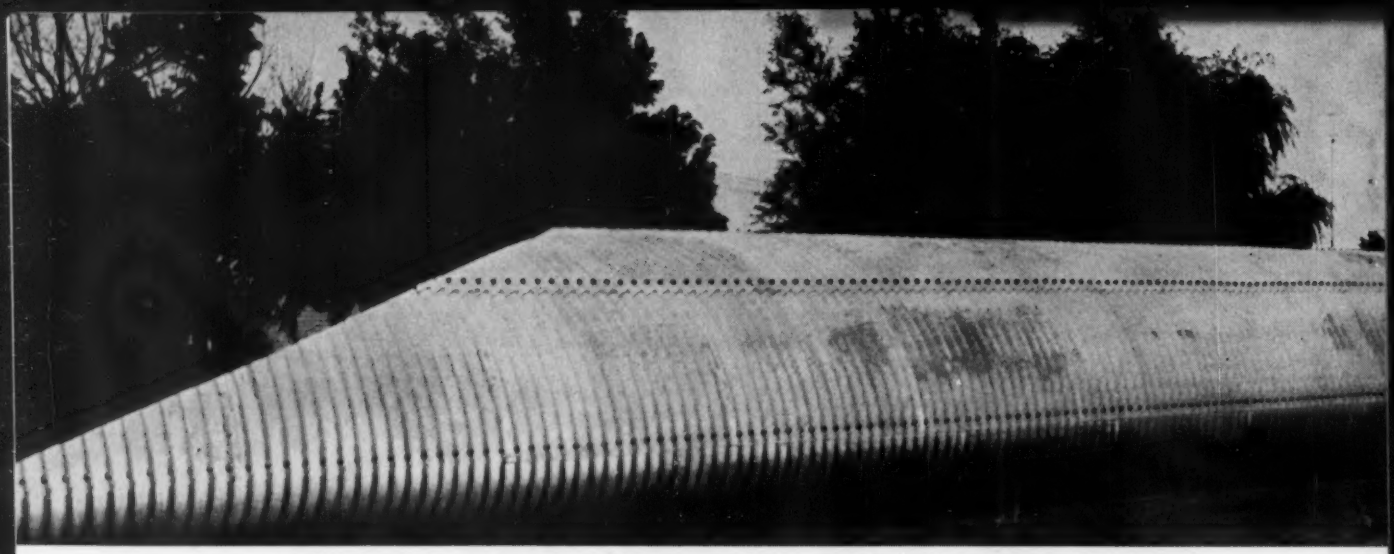

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Carolina Culvert & Metal Div. Florida Steel Corp.
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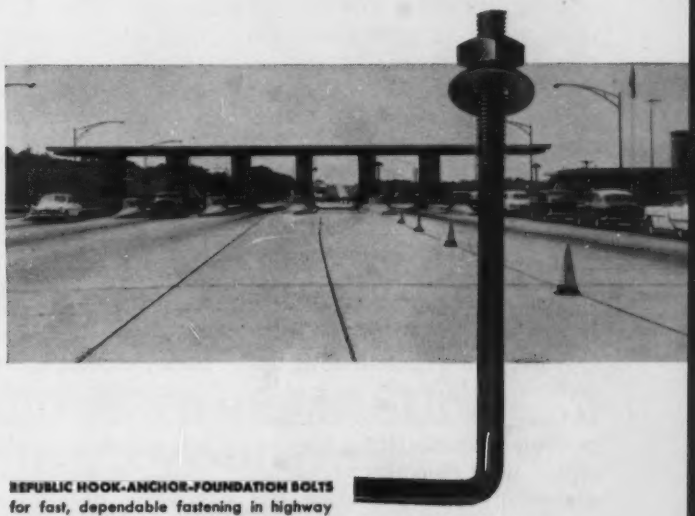

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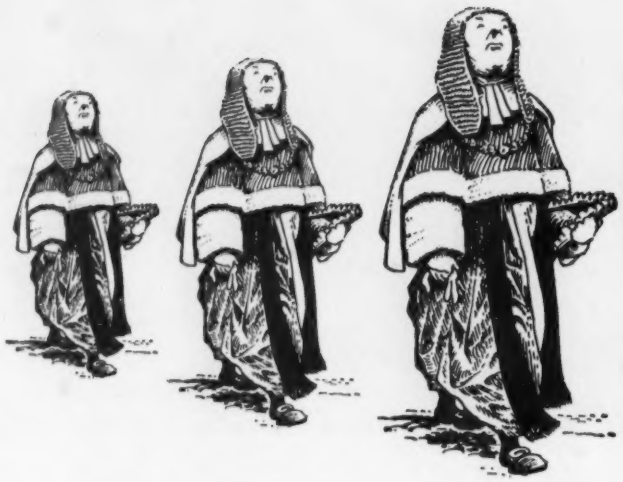

The Legal Aspect

MELVIN NORD, P.E.
Consultant in Legal and Technical Problems
Patent Attorney

Engineers, the Law, and Interstate Commerce

CONSULTING ENGINEER's readers are familiar with the case of *Mitchell v. Lublin, McGaughy & Associates*. In that Supreme Court decision of Jan. 12, 1959, it was held that the nonprofessional employees of an engineering firm (i.e., draftsmen, fieldmen, clerks, and stenographers) were covered by the Fair Labor Standards Act because the activities of these persons constituted "engaging in interstate commerce." The fact that the employer's activities may not have constituted "engaging" in interstate commerce was held irrelevant.

While, in a technical sense, this decision applied only to Lublin, McGaughy & Associates and their particular activities, it has been accepted since then that consulting engineers, generally speaking, had better accept it as fact that they have to pay overtime rates to their nonprofessional employees for their overtime hours.

A Recent Decision

Almost exactly a year later (Jan. 18, 1960), the United States Supreme Court handed down another decision relating to the Fair Labor Standards Act. It did not involve a consulting firm, but consultants may be affected by the decision.

Mitchell v. De Mario Jewelry was a suit brought by the Secretary of Labor to enjoin violations of the Fair Labor Standards Act, which also makes it unlawful for an employer under the act to discharge or discriminate against any employee because the employee has filed a complaint or instituted any proceeding under this act.

In the present case several employees had sought the aid of the Secretary of Labor. The Secretary, pursuant to the Act, and on behalf of the employees, brought an action for the recovery of wages which were not paid as required by the statute. The employer then "commenced a course of discriminatory conduct against three of the complaining employees, culminating in their discharge." The Secretary of Labor then brought a second suit, pursuant to the Act, to enjoin these actions of the employer. The U. S. District Court granted the injunction against further discrimination and ordered reinstatement of the three discharged employees, without loss of seniority. The Secretary also asked, on behalf of the employees, for payment of wages they had lost as a result of the unlawful discharge.

The defense, as to the latter issue, was that the statute provides that in any suit by the Secretary for an injunction to restrain violations, "no court shall have jurisdiction . . . to order the payment to employees of unpaid minimum wages or unpaid overtime compensation . . . " The District Court was not certain whether this prevented it from granting recovery of the lost wages.

The United States Supreme Court held, on this point, that the court had the inherent equitable power to order reimbursement since the statutory prohibition related to "unpaid wages," and not to "lost wages." The court said, "Respondents cannot be heard to assert that wages are ordered to be paid for services which were not performed, for it was the employer's own unlawful conduct which deprived the employees of their opportunity to render services."

This U. S. Supreme Court decision has removed a conflict between the decisions of the Federal Courts of Appeals of two circuits.

National Labor Relations Act

A recent case involving employees in construction projects was *Plumbers, Steamfitters, Refrigeration, Petroleum Fitters, and Apprentices of Local 298 v. County of Door*, decided May 4, 1959.

The County of Door, Wisconsin, sought to enjoin union picketing of a county courthouse construction project to induce a contractor who had successfully bid for plumbing work on the project to sign a union agreement. The pick-

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eting was peaceful, but it effectively stopped all work on the project, since union members employed by other contractors refused to cross the picket line.

The County, the general contractor, and the picketed plumbing contractor sought to enjoin this picketing in the state court. The union claimed, however, that the state court had no jurisdiction over the matter, since it was exclusively within the jurisdiction of the National Labor Relations Board. The trial court held that interstate commerce was not involved and issued an injunction. The Wisconsin Supreme Court affirmed the judgment of the trial court, and the case then was appealed to the United States Supreme Court.

The United States Supreme Court reversed these decisions, holding that interstate commerce was affected. The total cost of the project was about $450,000. Roughly half of this was the cost of materials brought from outside Wisconsin. Thus, interstate commerce was clearly affected. The fact that a county was involved was held not to be relevant, even though the NLRA expressly excludes political subdivisions from its definition of "employer." Thus, the National Labor Relations Board had exclusive jurisdiction over this labor dispute.

It should be noted that the requirement in cases of this type is much less restrictive than in cases arising under the Fair Labor Standards Act, where the employees must be *engaged* in interstate commerce. In the case of the National Labor Relations Act, the employee's activity merely must *affect* interstate commerce.

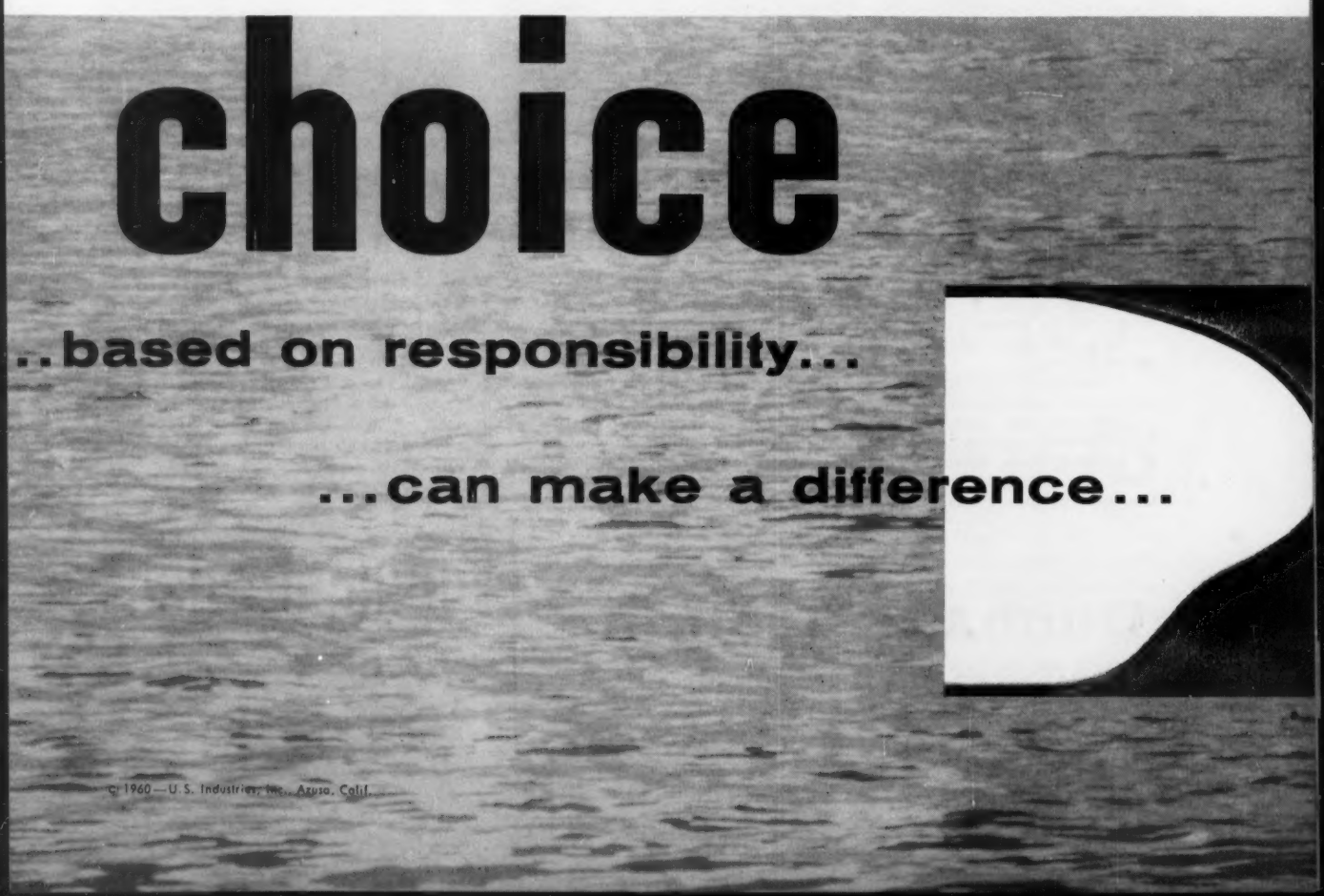
It also should be kept in mind that the state courts have power to intervene where the picketing is not peaceful but includes violence. This is so even though interstate commerce is involved.

The Hobbs Act

As an indication of the great range of problems in which interstate commerce may affect consulting engineers or their clients, consider the case of *Stirone v. United States,* decided by the U. S. Supreme Court, Jan. 11, 1960.

In this case the defendant was indicted for interfering with interstate commerce in violation of the Hobbs Act. This statute provides a fine of $10,000 and/or a term of 20 years imprisonment for anyone who "in any way or degree obstructs, delays, or affects [interstate] commerce or the movement of any article or commodity in commerce, by robbery or extortion or attempts or conspires so to do, or commits or threatens physical violence to any person or property in furtherance of a plan or purpose" to violate the Act.

From 1951 to 1953, Rider had a contract to supply ready-mixed concrete from his plant in Pennsylvania to be used for the erection of a steel processing plant at Allenport, Pennsylvania. For the purpose of performing this contract, Rider "caused supplies and materials (sand) to move in interstate



commerce" from outside the State to his plant in Pennsylvania.

The indictment charged that Stirone, using his influential union position, "did . . . unlawfully obstruct, delay, and affect interstate commerce . . . by extortion . . . of $31,274.13 . . . induced by fear and by the wrongful use of threats of labor disputes and threats of the loss of, and the obstruction and prevention of, performance of his contract to supply ready-mixed concrete."

The District Court permitted the government to offer evidence of an effect on interstate commerce not only in sand brought into Pennsylvania from other states but also interference with steel shipments from the steel plant in Pennsylvania into Michigan and Kentucky. The trial judge also charged the jury that either of these two kinds of effects on interstate commerce would be sufficient to bring in the Hobbs Act.

The United States Supreme Court held that the lower court was correct as to the hindering of movement of sand to Rider's plant. As to the movement of steel from Rider's customer's steel mill to points outside the state, the court refused to decide, because this was not included in the indictment against the defendant. Since it was not in the indictment, the court held it was error to consider it at all. The judgment of conviction was reversed, as this was held to be a fatal error.

In any event, the case indicates, to some extent at least, the nature of the protection afforded persons or firms whose activities involve interstate commerce. It is particularly interesting in that it indicates that while a firm may come under certain "burdens" because of the "interstate commerce" nature of its activities, it also is entitled to certain "benefits" for the same reason.

Thus, it is clear that interstate commerce has wide ramifications, Consulting engineers and their clients often may be among those most affected. ▲▲

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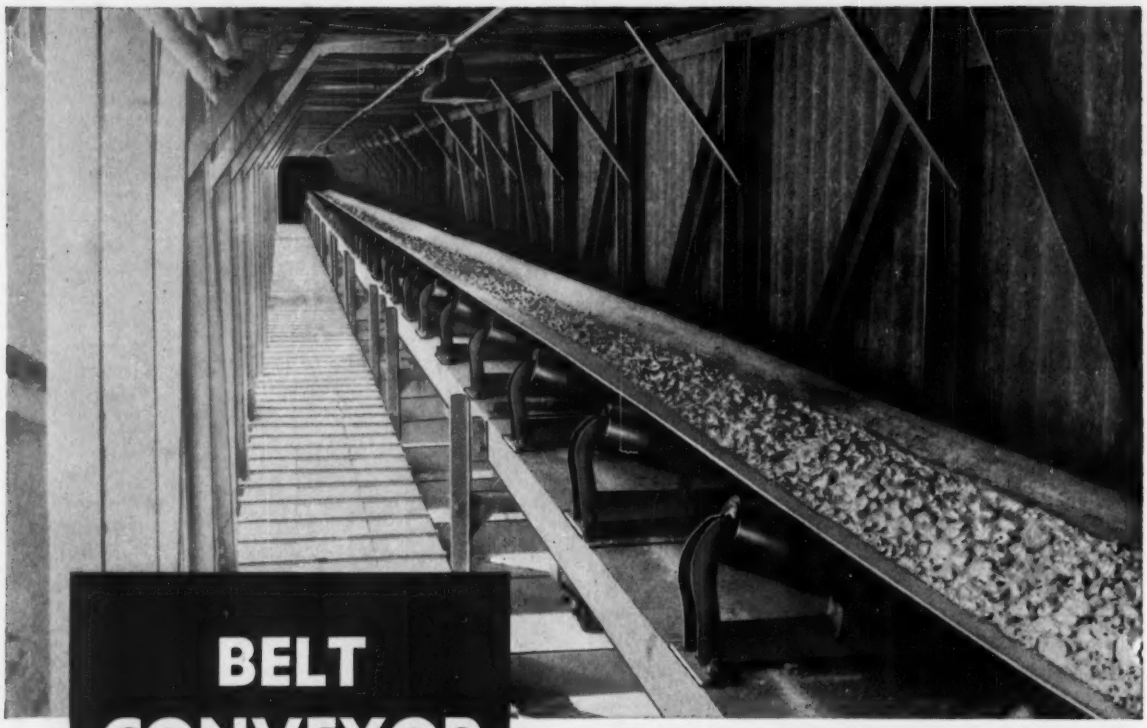

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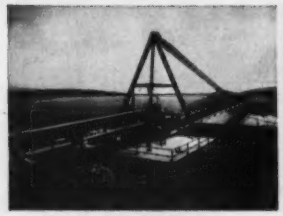

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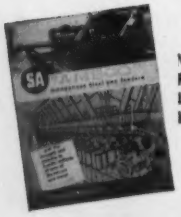

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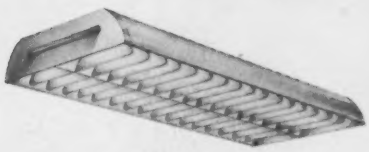

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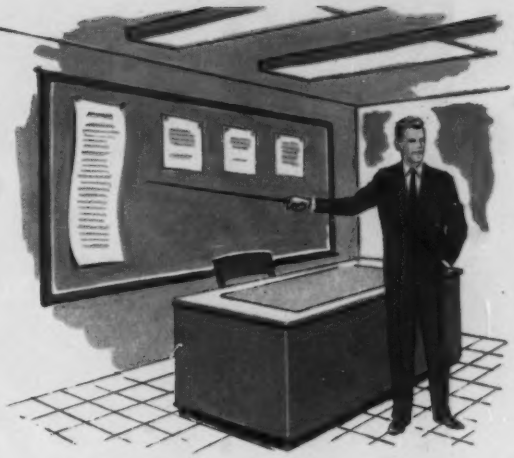

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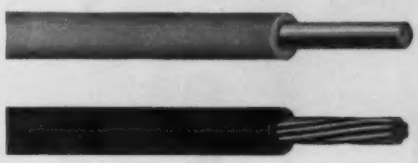
You can get Rome Synthinol 901 for operation at maximum temperatures of 60, 80, 90 and 105 C., depending upon the installation



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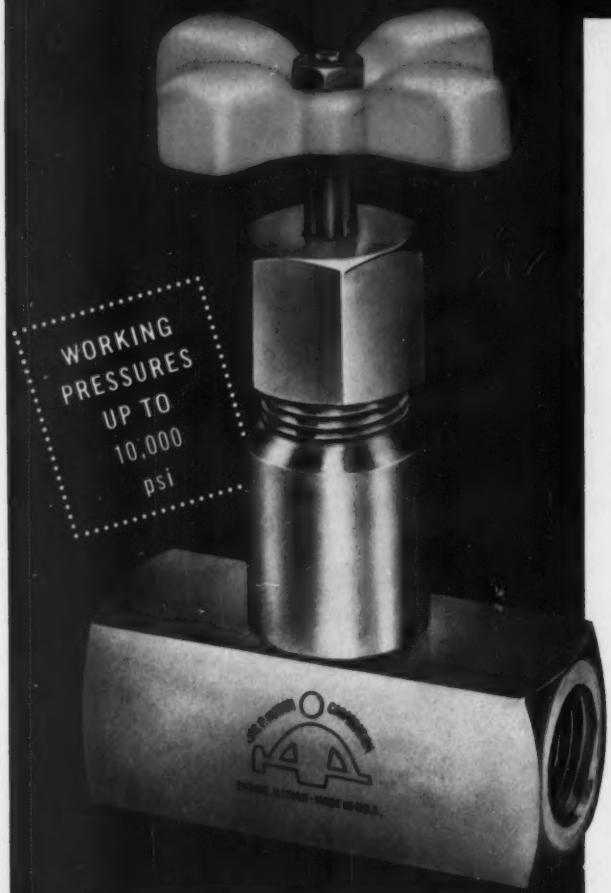

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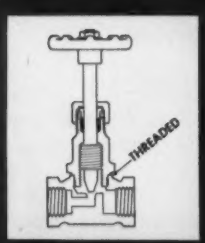
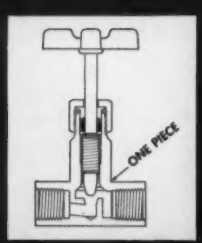


Conventional Construction



Marsh Construction

In conventional valve (left) stem-guide is threaded into body . . . can be backed out when valve is fully opened, causing real trouble when pressure is high. Can't happen with Marsh design (right). Marsh stem-guide is welded to body.

MARSH

SERIES 1900

Needle Valves

The Word From Washington

EDGAR A. POE, Consulting Engineer Correspondent

UNREALIZED EXCEPT among the government agencies responsible for dealing with the problem, there has occurred since World War II a fundamental change in government personnel procurement of the greatest significance to the engineering profession. Demand for engineering skills today is a major preoccupation of government recruitment. No longer need the public sympathize with the low pay scale of the civil service engineer. Salaries have risen rapidly and now appear to be well in line with pay to engineers in industry or in consultants' offices. The government demand for engineers continues and the supply is not increasing at the same pace. The result is that a higher and higher percentage of engineers and scientists are going into government service at regularly increasing civil service pay scales.

In 1940, there was one scientific or technological worker in the nation's labor force for every 100 workers. By 1957, the ratio was one scientific or technological worker per 32 workers. Civil Service Commission, in surveying its own procurement problem, currently estimates that in Federal service alone, one in every 10 of its personnel on government agency work is engaged in a scientific or technical job.

TABLE I — SEQUENCE OF INCREASES UNDER SECTION 803 OF THE CLASSIFICATION ACT FOR ENGINEERS

1. Action of February 21, 1955
   - Grade 5: from $3,410 (normal 1st step) to $4,035 (6th step)
   - Grade 7: from $4,205 (normal 1st step) to $4,580 (4th step)
2. Action of July 1, 1955 (to adjust rates as a result of passage of Salary Increase Act of 1955)
   - Grade 5: from $4,035 (6th step) to $4,345 (6th step)
   - Grade 7: from $4,580 (4th step) to $4,930 (4th step)
3. Action of April 3, 1956
   - Grade 5: from $4,345 (6th step) to $4,480 (7th — top step)
   - Grade 7: from $4,930 (4th step) to $5,335 (7th — top step)
4. Action of June 27, 1956
   - Grade 9: from $5,440 (normal 1st step) to $6,115 (6th step)
   - Grade 11: from $6,390 (normal 1st step) to $7,035 (4th step)
5. Action of August 10, 1956 (for highly specialized categories of engineers recruited largely for National Advisory Committee for Aeronautics)
   - Grade 9: from $ 6,115 (6th step) to $6,250 (7th — top step)
   - Grade 11: from $ 7,035 (4th step) to $7,465 (6th — top step)
   - Grade 12: from $ 7,570 (normal 1st step) to $ 8,645 (6th — top step)
   - Grade 13: from $ 8,990 (normal 1st step) to $10,065 (6th — top step)
   - Grade 14: from $10,320 (normal 1st step) to $11,395 (6th — top step)
   - Grade 15: from $11,610 (normal 1st step) to $12,690 (5th — top step)
   - Grade 16: from $12,900 (normal 1st step) to $13,760 (5th — top step)
   - Grade 17: from $13,975 (normal 1st step) to $14,835 (5th — top step)
6. Action of December 9, 1957 (to raise all professional engineering categories to steps in Item 5)
7. Action of June 20, 1958 (to adjust special existing rates on a dollar basis to new rates established as a result of the Employees Pay Act of June 20, 1958)
   - Grade 5: from $ 4,480 (former 7th — top step) to $ 4,490 (4th step in the new pay schedule)
   - Grade 7: from $ 5,335 (former 7th — top step) to $ 5,430 (4th step in the new pay schedule)
   - Grade 9: from $ 6,250 (former 7th — top step) to $ 6,285 (3rd step in the new pay schedule)
   - Grade 11: from $ 7,465 (former 6th — top step) to $ 7,510 (3rd step in the new pay schedule)
   - Grade 12: from $ 8,645 (former 6th — top step) to $ 8,810 (3rd step in the new pay schedule)
   - Grade 13: from $10,065 (former 6th — top step) to $10,130 (2nd step in the new pay schedule)
   - Grade 14: from $11,395 (former 6th — top step) to $11,595 (2nd step in the new pay schedule)
   - Grade 15: from $12,690 (former 5th — top step) to $12,770 (normal 1st step in the new pay schedule)
   - Grade 16: from $13,760 (former 5th — top step) to $14,190 (normal 1st step in the new pay schedule)
   - Grade 17: from $14,835 (former 5th — top step) to $15,375 (normal 1st step in the new pay schedule)

Salary Reviews

To compete with all the other fields in search of trained technical people, Civil Service Commission has had to keep under almost constant review the salary grades of interest to these persons. Table 1, prepared

by Civil Service Commission at the request of CONSULTING ENGINEER, and here reported for the first time, provides dates and details of the actions that have resulted.

As a single illustration, it became necessary after passage of the Federal Highway Act in 1956 for CSC to review its standards for highway engineer. This resulted in upgrading some 400 highway engineer positions. Furthermore, as grade levels are pegged to the Federal-aid highway program, it is going to be necessary, says the Commission, to review these standards again, upon completion.

It is significant that during the period in which the ratio of engineers or technological personnel increased so markedly, total Federal employment under all wage systems rose only 12.3 percent.

From 1947 to 1958, according to Commission records, professional and subprofessional employees combined rose in number from 51,098 to 79,377; this 42 percent gain compares with a jump of 77 percent for those in the biological science group, and 76 percent for those in the physical science group. A by-effect from the increased numbers of scientists and engineers which the Commission has had to procure is a general upward trend in salary grades, with the average grade of engineering and scientific personnel higher than for most of the other occupations reported.

Congressional committees concerned with salary appropriations have expressed some querulousness, but they have finally, in most instances, had to recognize the situation. As the Commission informed one committee recently, "The initiation of new and additional research programs, and the increasing complexity of research and development programs, generally have presented novel problems of a particularly high order, requiring competence beyond that previously anticipated."

TABLE 2 — ENGINEERING PERSONNEL

	1947	1958
Engineering — all classifications	51,098	79,377
General engineering	764	9,012
Engineering aid and technician	9,418	15,763
Safety engineering	491	553
Fire prevention engineering	92	104
Maintenance engineering	274	321
Materials engineering	741	839
Architectural engineering	580	599
Civil engineering	6,238	6,264
Construction engineering	1,418	3,894
Structural engineering	778	1,101
Hydraulic engineering	1,106	1,820
Cartographic drafting	4	1,069
Engineering drafting	5,899	—
Sanitary engineering	none listed	593
Highway engineering	848	1,520
Highway research engineering	—	—
Highway design and drafting engineering	—	7,778
Highway construction and maintenance engineering	1	1,520
Bridge engineering	99	220
Mechanical engineering	4,030	360
Automotive engineering	109	—
Automotive research, development, and design engineering	—	—
Internal combustion power plant research, development, and design engineering	—	1,053
Ordnance engineering	1,281	—
Ordnance design engineering	154	—
Electrical engineering	3,335	3,750
Electronic engineering	—	6,358
Aeronautical engineering	1,693	3,186
Airways engineering	565	307
Marine engineering	561	621
Naval architecture	829	1,147
Mining engineering	147	392
Petroleum production and natural-gas engineering	149	139
Agricultural engineering	563	992
Ceramic engineering	45	45
Chemical engineering	517	994
Welding engineering	—	59
Industrial engineering	330	1,292
Valuation engineering	255	274

Miscellaneous engineering made up the balance.

Grade Changes

This has led to a shifting within salary grade ranks to man the necessary positions. Thus in 1947, some 49 percent of professional engineers were in salary grades 5 through 9 (Table 1). By 1958, only 21 percent were in the same grades. During this period, the percentage of engineers in grades 13 and above increased from 10 percent in 1947 to 28 percent in 1958. Thus, there has been a huge increase, both in numbers and in salary grade level, since 1947. Table 2 illustrates this trend by areas of activity.

Not all government agencies having substantial engineering staffs are under Civil Service; TVA and AEC are among the exceptions. Generally speaking, however, the standards promulgated by the Commission are a benchmark. The rapidity with which the Commission has had to act in the present situation is indicated by the fact that, according to Commission spokesmen, it will set up 35 to 40 standards for various fields in fiscal 1960, and this rate probably will apply in the nearest approaching fiscal years, it is said.

Not all engineering segments have felt much change from all this grade revision. For example, it is

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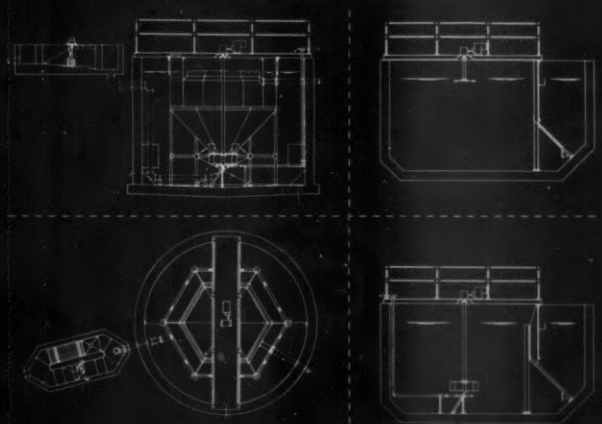

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stated that there has been less impact among the traditional civil, electrical and mechanical engineers than among some of the newer and more specialized types.

Facts on Recruitment

Informally (because CSC does not routinely collect data on all aspects of the problem) it is estimated that recruitment and retention of scientists and engineers is easier than it was 5 or 6 years ago, but as of the end of 1959, not as easy as in 1957 or 1958. However, the Commission is gathering more complete data now to indicate what effect it can expect from higher than minimum rates, and the various agencies' experience in recruiting technical and scientific professional personnel.

Such information as it has now indicates that in 1954, for instance, prior to adoption of the Congressional Act (Section 803 of the Classification Act, to permit more flexibility in the range of Federal salaries for specialized personnel) Federal authorities were experiencing an acceptance rate of only 17 percent for engineers, and certain physical scientists in grades 5 and 7 (Table 1). By 1956, the rate was boosted to 29 percent for this personnel under the impetus of the better salary inducements made possible by this law. In 1958, Federal offers for these employees was meeting 40 percent acceptance against 46 percent in private industry. The acceptance rate for engineers was 37 percent in 1958, and for physical scientists 49 percent, in Federal recruitment.

The Commission reports that its own findings support those of the Labor Department of a few months ago, which showed, in substance, improving job opportunities and a diminishing supply of available engineers. The Commission now is reviewing all data it can find to determine results from the improved salary ranges, particularly for engineers in grades 5 and 7.

Future Projections

CSC now has data to support a projection of engineering and scientific engineering manpower requirements for the next five years, based on the views of Federal agencies employing about 90 percent of personnel in these categories. These figures have not been published, but the Commission states that from 1954 to 1957, employment of engineers, physical scientists, and technicians included in the study of 1963 requirements increased 9.7 percent, or an average of 3.2 percent per year. From 1957 to 1958, or more precisely in a period of approximately 18 months, there was an increase of 11.6 percent.

Federal agencies have advised the Commission that they estimate their manpower requirements in these occupations will continue to increase to 1963, and then will exceed 1958 employment in these categories by 25 percent. ▲▲

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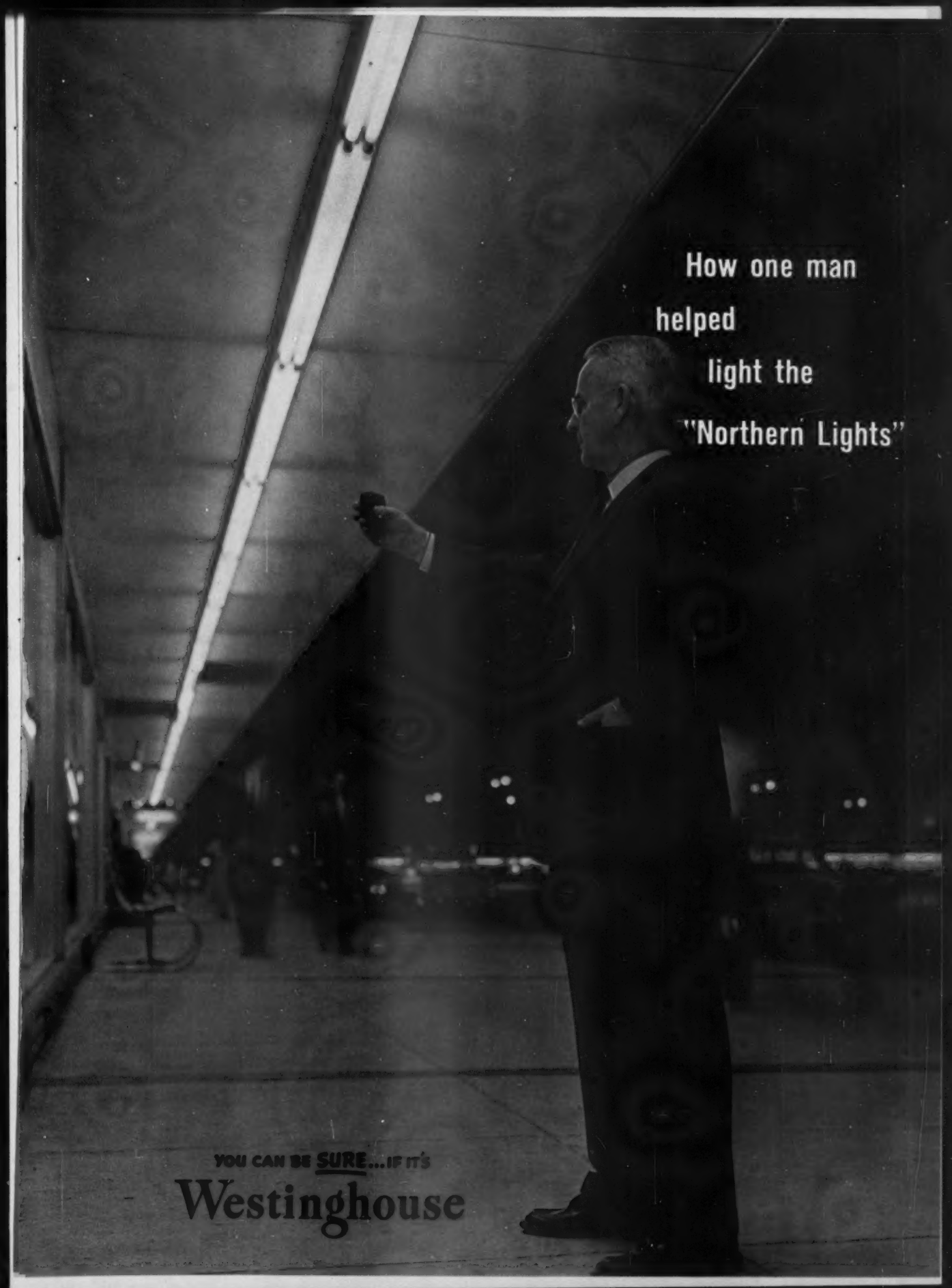
How one man
helped
light the
"Northern Lights"
YOU CAN BE SURE... IF IT'S
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Building—Northern Lights Shopping Center, Conway, Pennsylvania

Owner and Developer—Don M. Casto—Don M. Casto, Jr.

Architect—C. Melvin Frank, A.I.A.

Owner and Builder—Joe Skilken

Electrical Contractor—E. C. Ernst, Incorporated

OUTDOOR—Curtis Lindberg, partner of architect C. Melvin Frank, discusses parking safety and convenience with Westinghouse lighting engineer, Ken Flint.

The brightly illuminated Northern Lights parking lot is an invitation to stop and shop. A cheery, roomy look was created with the carefully calculated use of Westinghouse luminaires. Traffic moves safely and surely. Annoying fender-bending is kept at an absolute minimum. Shoppers walk to and from their cars in complete safety.

Inexpensive, practical and attractive Slimline units light walkways. Spotlighting by Westinghouse adds dramatic touch.

TEAMWORK—Ken Flint (far right) helps iron out details of lighting system with (left to right) Joe Skilken, owner and builder; C. Melvin Frank, architect; Don M. Casto and Don M. Casto, Jr., owners and developers. Conferences were also held with prospective tenants.

Westinghouse lighting engineer helped coordinate lighting at Northern Lights Shopping Center

Your Westinghouse Lighting Engineer—Ken Flint

Behind the taken-for-granted convenience of shopping center shopping lies an unusual lighting problem. Department stores, supermarkets, specialty shops, banks, restaurants, a parking lot—each has its specific lighting requirements . . . requirements that must be taken into consideration in the over-all planning.

A HELPING HAND—In engineering the lighting installation for the Northern Lights Shopping Center at Conway, Pennsylvania, architect and consulting engineer, C. Melvin Frank, sought the best counsel and assistance available. He found it in the Westinghouse lighting engineer—a man with ideas—a man who knows lighting *and* construction. His name—Ken Flint.

DEPTH IN SERVICE—Flint got into the act early and stayed late . . . from the original proposal and writing of specifications right down to delivery and actual installation. Specifically, Flint coupled his product knowledge with Frank's architectural skill in working out lighting plans for prospective local tenants. Knowing his way around, Flint added the Westinghouse Chain Marketing representative to the team in determining the lighting requirements of the national chain stores. The versatile lighting engineer also lent his experienced hand in helping the architect design attractive, practical parking lot, walkway and floodlighting installations. One order placed through one distributor from one manufacturer—Westinghouse—wrapped up the complete lighting package.

Throughout all planning, negotiations and construction, Flint was there *when needed.* His product information and application assistance played an important part in providing proper lighting, reducing costs and speeding the job to completion *on schedule.*

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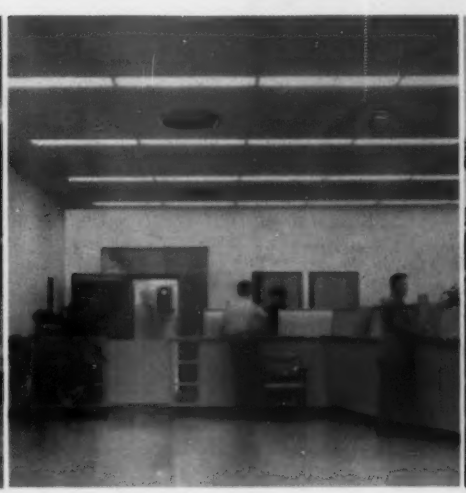

INDOOR—A bakery shop, a bank and a national auto supply chain store are indicative of the variety of lighting problems encountered in a shopping center. Each store's lighting layout was approached from the standpoint of customer and employe comfort and convenience . . . of utilizing lighting as a sales tool. As a result, practically every type of functional, decorative and accent lighting has been engineered into the system. In effect, the necessity for "coordinated diversity" has made Northern Lights a showcase of Westinghouse lighting products and application skill.

There are 70 Westinghouse lighting engineers —and there's one near you

PREPLANNING INSPECTION—Flint and architect Lindberg examine recently introduced *Triumph* luminaire. To aid the architect in planning, the Westinghouse lighting engineer supplied sample fixtures and detailed engineering information on the varied requirements of the many stores.

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Ken Flint is one of 70 capable, experienced Westinghouse lighting engineers located all over the United States. A phone call to your nearest Westinghouse Apparatus sales office gets you all the technical advice you want or need on all types of lighting—indoor, outdoor, decorative and recreational.

Check the list of the many special services available from your Westinghouse lighting engineer. For more information write: *Westinghouse Electric Corporation, Lighting Division, Edgewater Park, Cleveland, Ohio.*

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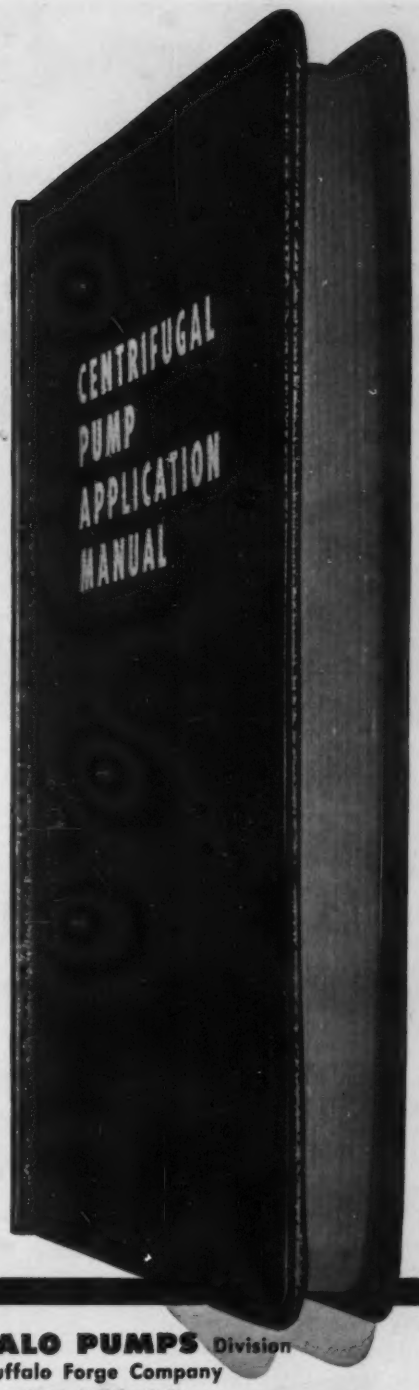

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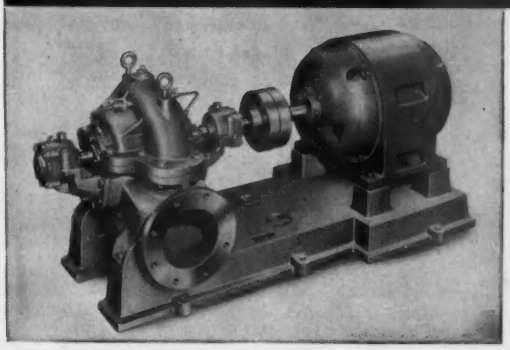

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Civic thrift at Kingfisher prompts Superior Engine purchase

Kingfisher, an Oklahoma wheat belt town of 3700 population, is proud of its low municipal taxation. Earnings from the city-operated power plant pay most local operating expenses and finance periodic improvements and expansion to the plant itself. As usual, city fathers were both cautious and thrift-minded when a new engine-generator was needed recently. Their choice was a Model 80-GDSX-8 dual-fuel supercharged Superior which develops 1769 BHP at 360 RPM, to drive a 1250 KW generator.

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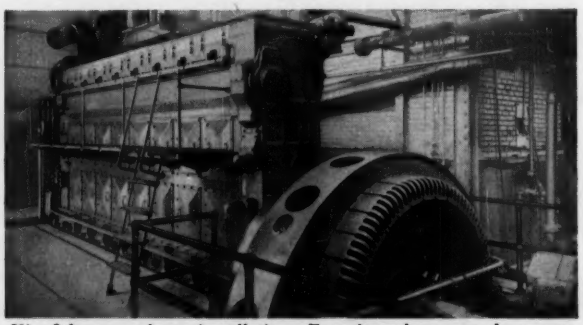

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MARJORIE ODEN,
Eastern Editor

THE Consulting Engineers Council executive committee, at a recent meeting in Springfield, Illinois, authorized President Ralph Westcott to conduct a fund raising program aimed at combatting Federal, state, and municipal government statements that it is cheaper for government agencies to do their own engineering design.

Westcott named a three-man committee – L. K. Crawford, chairman; C. C. Pate; and Orley Phillips – to administer the program. Contributions will be voluntary and will be kept in a separate account from other Council money, Westcott stressed.

The money collected will be used for a public relations counsel, investigations, travel expenses, telephone calls, and to solicit more funds. The campaign will stress engineers' cost factors, with particular emphasis on the highway program. And Westcott said no attempt will be made to conduct a general advertising or publicity program.

According to the *Newsletter* of the CEC-affiliated Illinois Association of Consulting Engineers, Westcott said, "Obviously the situation is becoming increasingly critical. The question arises . . . What can be done? A number of organizations, in addition to CEC, have a stake in this matter. The unfortunate truth is, however, all but CEC have the problem of 'conflict of interest' within their own membership. Consulting Engineers Council is, apparently the *only* organization which can carry on the consultants' fight, if there is to be one and, from all indications, there must." The Illinois Association already has contributed $1000 to the emergency program.

CEC Annual Meeting

Gearhart, Oregon will be the scene of the annual meeting of the Consulting Engineers Council, from May 2 through 7. Harry Czyzewski, director of CEC from the Oregon Association, is co-chairman of the meeting with Delmar L. McConnell. Other members of the committee are Irving E. Olsen, registration; Keither Kruchek, programs; Mrs. Thomas R. Miles, ladies activities; and Harry J. Woelber, publicity and finance.

The executive committee will meet on May 2 and 3, with the board of directors scheduled for meetings the remainder of the week. The annual meeting of the Consulting Engineers Association of Oregon will be held in conjunction with the national meeting on May 5, and both state and national officers will be installed that evening.

New Council Yearbook

Consulting Engineers Council now is in the process of distributing its new two-volume yearbook. As President Ralph Westcott explained, one volume is a membership directory prepared for the use of members only. The second volume is an expanded Manual, telling the story of the Council and its committees, and suitable for distribution to the public.

CEC Membership

Tennessee is expected to hold a formal organizational meeting for a consulting engineers association late this month. With a founder membership of 14 firms, the group already has an executive secretary.

Elsewhere on the membership front, Massachusetts, South Carolina, South Dakota, and Virginia look like early prospects for CEC member groups. Prospects are not so immediate in the Washington, D. C., and Maryland associations. Both have been organized for some time, but are concentrating on local problems.

FIDIC Representative

William W. Moore, of Dames & Moore, San Francisco, has agreed to act as Consulting Engineers Council representative to the International Federation of Consulting Engineers (FIDIC) meeting in Stockholm next spring. Moore is a past president of the Consulting Engineers Association of California and was that Association's first member on the board of the Consulting Engineers Council at its organizational meeting. He is also a past president of the Structural Engineers Association of Northern

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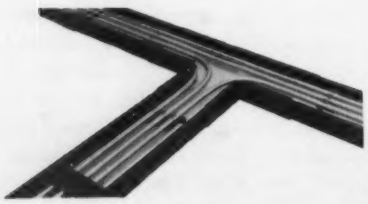

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Mr. and Mrs. Moore were members of the first CONSULTING ENGINEER's European Tour in May 1956, meeting with many of the national associations of consulting engineers affiliated with FIDIC. His reputation and background in both national and international affairs fully qualifies him as a Council representative to the International Federation. Also representing the CEC will be Edward Wolff, of Chicago.

Oregon Statute on Wage Rates

A revised Oregon statute requires that specifications for work on any public project must contain a list of the minimum wage rates that the contractor must pay the various classes of labor on the project. Since there is no central source for these rates, consulting engineers have a potential liability against which they must protect themselves. Until this situation can be cleared up, the Consulting Engineers Association of Oregon recommends the addition of a clause at the end of the section of the specifications where wage rates are listed. It reads as follows:

"The above minimum wage rates have been obtained from the appropriate labor jurisdictional agencies in the location of this project, and, to the best of our knowledge, they are correct. However, we assume no responsibility for the accuracy of any of the rates stated above, nor do these rates in any way affect those that may be required to be paid by the contractor in the execution of the work specified herein."

Withholding Retainers

The Joint Cooperative Committee of the Missouri Association of Consulting Engineers and the Associated General Contractors has agreed on the following statement regarding retainers:

"The withholding of a retainer should be for the sole purpose of securing final completion of a project or any separate portion thereof within the terms of the contract. Our committee endorses the retention schedule set forth below . . . similar to Standard Form 23A of the General Services Administration.

" 'In making such partial payments there shall be retained 10 percent on the estimated amount until final completion and acceptance of all work covered by the contract: Provided, however, That the Contracting Officer, at any time after 50 percent of the work has been completed, if he finds that satisfactory progress is being made, should make any of the remaining partial payments in full; And provided further, That on completion and acceptance of each separate building, public work, or other division of the contract, on which the price is stated separately in the contract, payment should be made in full, including retained percentage thereon, less authorized deductions.' On private work substitute the phrase 'owner or his representative' for the words 'Contracting Officer.' "

Canadian Salary Survey

The Corporation of Professional Engineers of Quebec has just completed its 1959 engineering salary survey. Median income for those reporting rose 7.7 percent over 1958, to $8400. Consulting engineers and those employed in industry enjoyed almost equal status in terms of salary, both having a median of $8500, and a little over 17 percent in each group enjoying an annual income of over $12,200. Lowest in the salary ranking were the engineers in civil service.

By Any Other Name

In 1928, the Federation of Sewage Works Association was formed. Ten years ago, Federation members decided the title was not descriptive of their full operations, so the name was changed to the Federation of Sewage and Industrial Wastes. Now the group has announced a more

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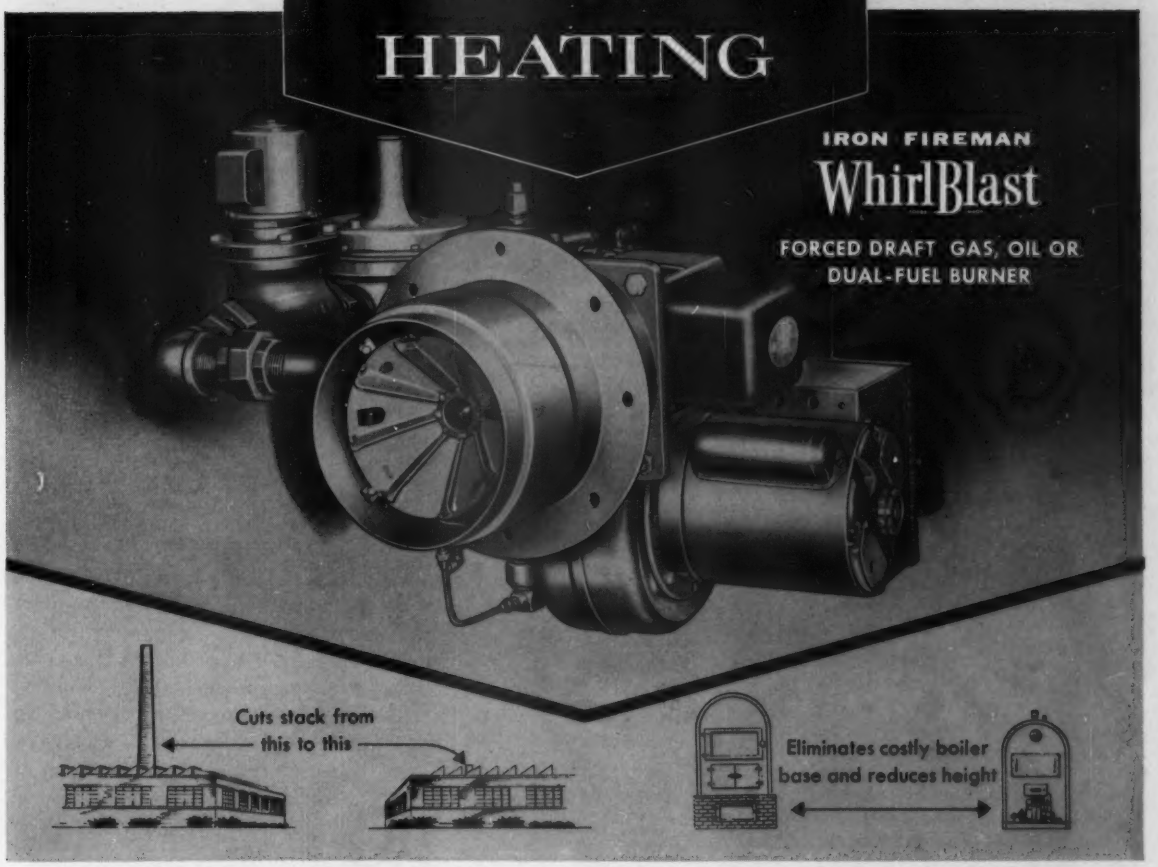
HEATING



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dignified title — away from the sewage. The new name is the Water Pollution Control Federation.

The organization's magazine also has taken on a more dignified title. *Sewage and Industrial Wastes* now is *Journal of the Water Polution Control Federation.*

Address of the organization is unchanged — still 4435 Wisconsin Ave., N. W., Washington 16, D. C.

Wheelock New EJC Secretary

L. K. Wheelock, who was assistant secretary of Engineers Joint Council from 1956 to 1959 and executive secretary of the Engineering Manpower Commission for more than a year, has been named secretary of EJC for a one-year term starting March 1.

E. Paul Lange, who had been EJC secretary for six years, opened a New York City office for the American Institute of Industrial Engineers in early March. Lange, executive secretary of AIIE, now is at 32 West 40th Street.

The naming of a secretary for a one-year term was something new for EJC. However, EJC spokesmen explained that many of the engineering organizations go through the formality of re-electing a secretary each year.

Wheelock still holds his post with the Engineering Manpower Commission, but he currently is trying to find a successor.

Jersey Planning Bill

The proposed licensing bill for professional planners in New Jersey is acquiring about the same historical reputation as corporate practice bills in New York State. The only sure things in the world are death, taxes, and the annual introduction of these bills. The two proposals have something else in common — perennial objections from their State Societies of Professional Engineers.

The New Jersey Planning Bill, now introduced for the third year, would give licenses and seals to professional planners. NJSPE objects, pointing out that similar bills have been introduced in a number of states, but "to date, no state has seen the necessity or desirability of passing such a law."

The engineers offered to have the engineering registration law amended so planners could become registered under it. The planners rejected the offer, deciding instead in favor of holding out for recognition as a separate profession.

The New Jersey Society published a list of reasons for objecting to the bill, which is backed by the National Association of Planners. Included in the discussion of objections is a statement that "It is felt by the Society that this Bill is merely the first step of this organization (the planners) and is intended to get a 'toe hold' in the field of engineering . . .

"It is also important to note that the group pressing for the passage of this bill which claims to represent 200 planners consists of actually approximately 60 planners, most of whom are not licensed as professional engineers or architects because they are not sufficiently qualified to pass the examinations."

On Feb. 1, the bill passed the Assembly by a vote of 37 to 11. The same day, it was referred to the Senate Committee on Business Affairs. And there it rested when the Senate adjourned on Feb. 15 for winter recess. The Legislature was scheduled to go back into operation in mid-March.

The proposed bill, almost identical to a bill submitted last year, begins by stating, "The work of the professional planner shall not include or supersede any of the duties, responsibilities, or prerogatives of licensed professional engineers, land surveyors, or registered architects of New Jersey."

Minimum qualifications for a planner include these options:

¶ A graduate degree in professional planning from an accredited college or university.

¶ An undergraduate degree, 21 credit hours in recognized plan-

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Here's an interesting job that's gone "push button"—stamping heat numbers on hot steel! Now, from a remote console, the operator automatically sets numbers on the marking head and propels it against the steel. The controls, *of course*, are Allen-Bradley because they provide the continuous reliability that is essential to this production.

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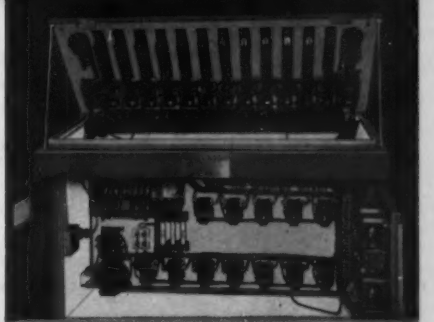

The relays and push buttons used in the remote control console of this M. E. Cunningham Marking Machine are all standard Allen-Bradley catalog items.

ning subjects, with a minimum of four years experience in full-time practice of professional planning.

¶ A degree in a closely related course, such as architecture, landscape architecture, engineering, law, sociology, geography, public administration, political science, or economics, with a minimum of 18 credit hours in recognized planning subjects, with a minimum of five years experience in full-time practice of professional planning.

¶ Proof he is a duly registered architect or a licensed professional engineer of the State of New Jersey, with at least three years experience, and approved by the Board.

One interesting – but probably unintentional – portion of the proposed bill provides a penalty for the use of an "unexpired or revoked certificate."

Nuclear Fission

Representatives of Engineers Joint Council again met with spokesmen for the American Nuclear Society and the Atomic Industrial Forum for talks about how to get together on a single nuclear show. Until this year, a Nuclear Congress was held jointly by the three. But ANS and AIF announced they preferred to hold a show of their own.

The second conciliatory meeting met with no more luck than had a similar earlier meeting. And now it is established that nothing more will happen until at least June, when the ANS representative has an opportunity to discuss the feelings of that organization toward future shows.

Summer in Reno

The U. S. Committee on Large Dams will hold a meeting on "Large Dams in the Western United States" in conjunction with the American Society of Civil Engineers summer conference, in Reno.

Among the current topics of discussion is the proposal for a world register, listing dams chronologically and giving both English and metric specification figures. Final decision will be made at the executive meeting of the International Commission on Large Dams, in Tokyo, next October.

Topics also have been selected for the International Commission's Seventh Conference, scheduled to be held in Rome next year. Papers are being accepted on:

¶ The selection, processing, and specification of aggregates for concrete for large dams.

¶ Underground works in connection with design and construction of large dams.

¶ Modern techniques of concrete dams and ancillary works for wide valleys.

¶ Sealing of earth and rockfill dams with bitumen and other materials.

Short Course for Consultants

The American Institute of Industrial Engineers is offering a course, lasting from Feb. 23 through May 3, on "The Engineer as a Consultant." Among the topics discussed are fees, ethics, and obtaining clients. The course is taught by a management consultant. ▲▲

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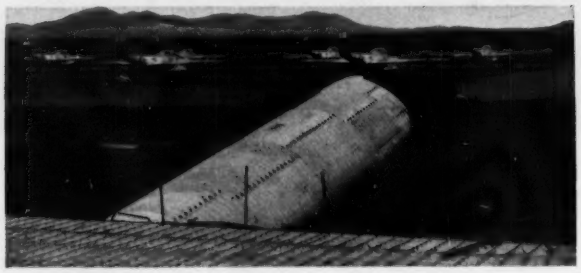
Engineers find Armco MULTI-PLATE Pipe solves unusual problems, too

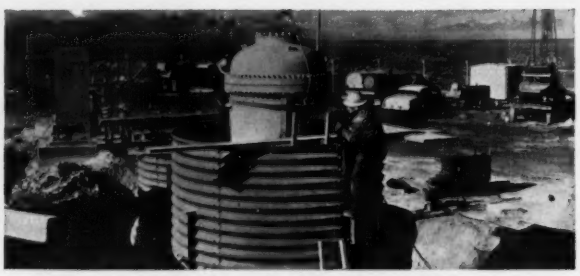
For many years, Armco MULTI-PLATE® Pipe has proved ideal as a drainage structure for highways, railroads, industries and municipalities. But frequently, engineers find these structures offer important design, strength or cost-saving advantages in *unusual* applications, too. Photographs on this page show some of these uses. May we help you determine whether MULTI-PLATE would solve *your* unusual problem?

Galvanized MULTI-PLATE Pipe is supplied in a wide range of diameters and gages. Assembly is by bolting together curved, corrugated metal plates. For engineering and dimensional data, write for catalog. Armco Drainage & Metal Products, Inc., 6280 Curtis Street, Middletown, Ohio.

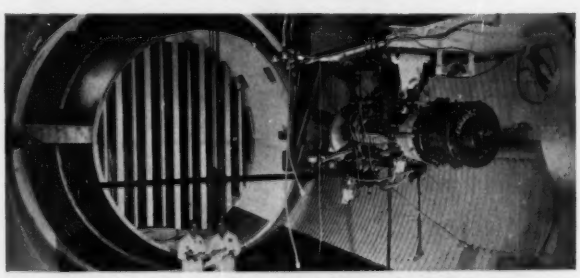
High on a mountainside, this MULTI-PLATE Pipe collects rainwater for a remote military installation.



Shown here during construction, MULTI-PLATE Pipe will be used as an exit ramp for SAC flight personnel.



This vertical Armco MULTI-PLATE Pipe is used by the AEC as a gallery for an atomic reactor.



Interior view of a large MULTI-PLATE Pipe being used as a cell for the testing of turboprop engines.

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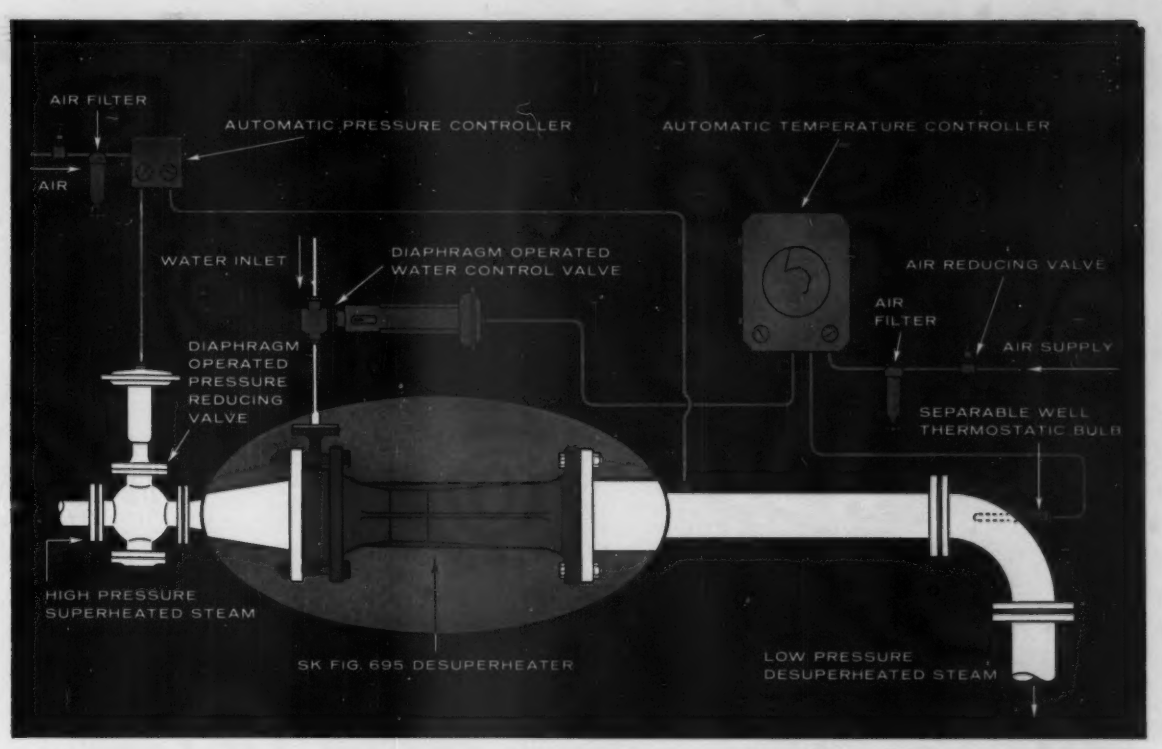
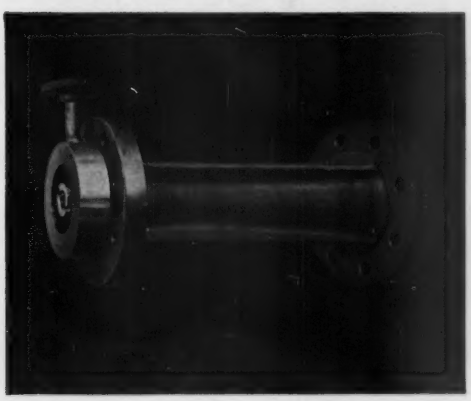


Reduce Steam Temperature for Process Operations

with this light, easily-controlled Desuperheater

SK Fig. 695 Venturi Type Desuperheater. An important feature of this desuperheater is the fact that the water need not be at higher pressure than the steam entering the desuperheater. As noted in description, right, water can enter the unit at inlet steam pressure.



The SK Venturi Type Desuperheater, shown in the illustrations above and at left, is designed to reduce the temperature of superheated steam to the lower temperatures required for use in process operations and for operating plant auxiliaries.

These Desuperheaters are light in weight and small in dimensions—are supported directly by the superheated steam line. In addition, they are simple in construction, provide straight-through flow with only a small pressure drop. Because these units are designed for application with automatic control, they are particularly well suited for process and petroleum plants where steam flow varies. They can, however, be used without controls where steam flow is steady. In such cases only a separator need be added.

The Venturi Type Desuperheater reduces steam temperature by bringing water into contact with the superheated steam. The water pressure is low since it need only equal the operating steam pressure. The water is preheated in the chamber around the water diffuser and issues, through many small jets, into the steam stream. Since the steam-water mixture is discharged through the desuperheater outlet in a fog-like condition, without contacting the sidewalls, maximum desuperheating effectiveness is obtained and minimum wear occurs in the discharge piping.

The particular desuperheater shown is one of four types made by SK for process plants. Complete details on all types are contained in Bulletin 6D. Write for a copy.

JET APPARATUS: Ask for Condensed Bulletin J-1.
ROTAMETERS & FLOW INDICATORS: Ask for Condensed Bulletin M-1.
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Gas heating can give your schools safe, economical service. For specific information, take advantage of the consulting services provided by your Gas company, as well as Mid-Continent. They have trained heating specialists who have been working with architects, engineers and school boards for years. If you want further information, check with your local Gas company's heating specialist, or write to Mid-Continent Metal Products Co., 1960 N. Clybourn Avenue, Chicago 14, Illinois. *American Gas Association.*

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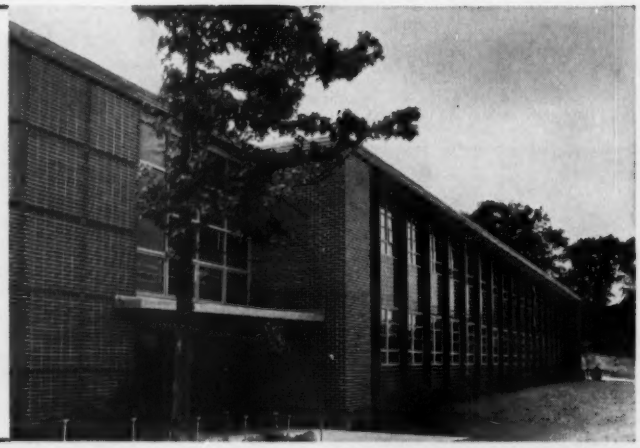

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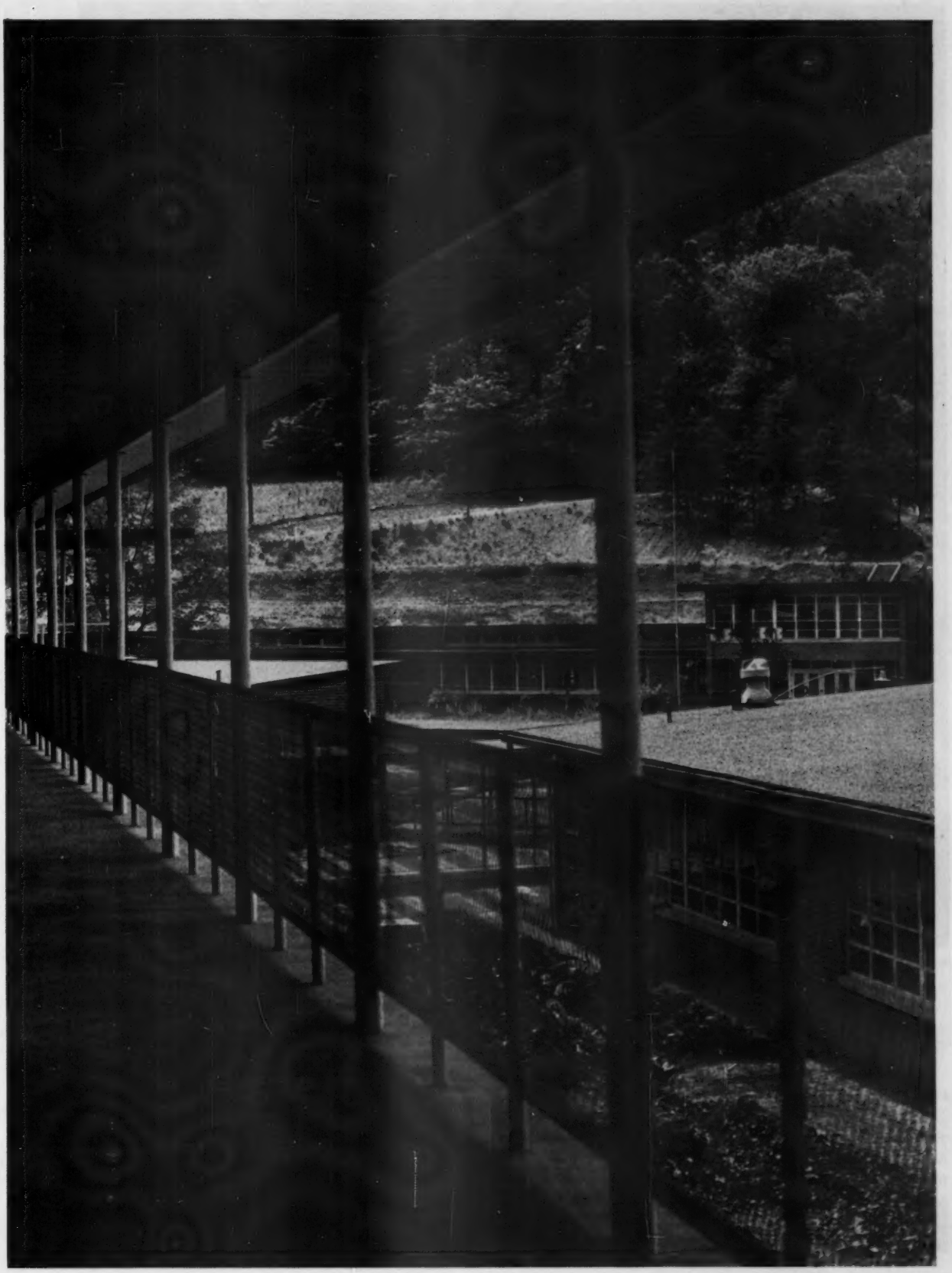
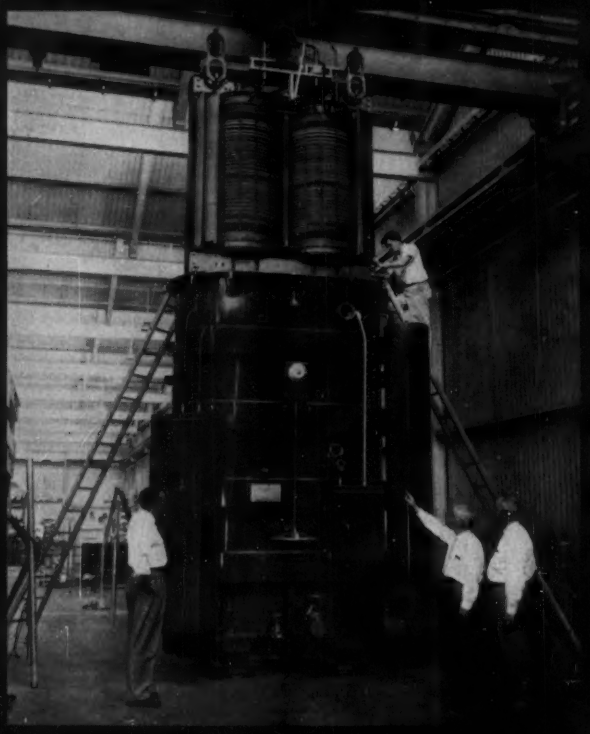
"With the style of architecture we want here in Birmingham, we find that it's more sensible to have small boilers in each building rather than try to build a central plant and pipe the heat to each building," states Mr. Fred J. Kelley, business manager of the City Board of Education. "In many of these new installations, we have specified Lo-Blast Power Gas burners because of their good record here in Birmingham for safe, consistent performance, plus low-cost installation and operation."



Federal Pacific offers nationwide delivery ...on a full line of transformers



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Reciprocal Registration... A Two-Way Street

RALPH S. TORGERSON
West Coast Editorial Representative

A Report from the West Coast

RECIPROCITY in the granting of registration to out-of-state professional engineer applicants has been the subject of much acrid comment. In at least one instance, retaliatory action has been taken by a registration board of one state against applicants from another state that allegedly had discriminated against the licensed professional engineers of the first state. "You hit me, and I'll hit you back."

If all state laws and regulations were uniform, reciprocity in registration and licensing would be general, but this ideal must be anticipated with pessimism. A model law governing professional engineer licensing and registration has been available since 1946 from the National Council of State Boards of Engineering Examiners, but it has served only as a rough guide for the various state legislatures. A proposed NCSBEE revision of the model law is expected in August 1960.

On the West Coast, California has taken most of the criticism of professional engineer applicants from other states seeking registration. The Registration Board, under the California Engineers Act, must conform to the law in determining qualifications of applicants. For example, to become qualified for registration and licensing as a structural engineer, the applicant must demonstrate a knowledge of and an education in seismic design. Yet, California engineering schools are about the only schools that include full courses in lateral stresses in their curricula. This constitutes a barrier to registration by out-of-state applicants — a barrier that cannot be removed by the Registration Board as it is erected by the law.

Another source of irritation to some applicants seeking registration is the refusal of California to recognize teaching as qualifying engineering experience. Some consideration is being given to a modification of this requirement, but Board members believe that an applicant whose experience is nearly all in teaching simply is not eligible for registration. This stand has stirred up considerable antagonism against the California Board.

California requires registration and licensing only of civil and structural engineers but permits registration of electrical, mechanical, petroleum, and chemical engineers. However, engineers in the permissive registration category may not offer their services to the public, setting themselves forth as being registered and licensed engineers unless they are, in fact, registered engineers. As a practical matter, there is a distinct advantage in registration, as some building codes require that drawings be signed by registered engineers. Many architects and contractors are reluctant to assume responsibility where drawings were prepared by nonregistered electrical or mechanical engineers.

For many years, mandatory registration has been sought in California for electrical and mechanical engineers, but it has not been accomplished because of opposition within the profession as well as outside. The inside opposition to mandatory registration for electricals comes largely from a few of the big engineering firms. For mechanical engineers, the opposition has come mainly from mechanical contractors. These contractors have been offering engineering services as inducements to clients and they are reluctant to give up this competitive advantage.

Chemical engineers opposing mandatory registration fear that in designing chemical processing plants, certain phases of the design may be construed as structural, electrical, or mechanical engineering, and thereby they might be restricted in their designing work. They have had difficulty in establishing a definition of their branch of engineering that would give them full freedom in design.

Another problem in reciprocity involves older applicants who feel

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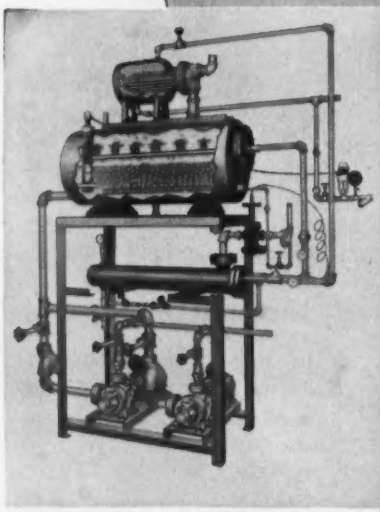

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they should not have to take an examination because they have been engaged in responsible engineering work for many years. The California Board has felt that these engineers should have their competence tested because they not only undertake design work themselves but pass upon the design and very often sign drawings of younger, less experienced engineers. This is always a difficult problem for any board of examiners. Usually these applicants are tested with a five minute oral and a two-hour written examination.

Most States Demand Registration

Arizona, Idaho, New Mexico, Nevada, Oregon, and Washington require registration of all engineers in private practice. Their practice on granting of reciprocity varies. In Arizona, the Board may register, without examination, an applicant who holds a valid certificate of registration issued by another state or even a foreign country, or who holds a certificate of qualification issued by the National Bureau of Engineering Registration. Provision also is made for a temporary permit to practice engineering for 90 days upon the payment of a fee of $50 by a nonregistrant holding a valid certificate of registration issued by another state.

Raymond J. Briggs, chairman of the Idaho State Board of Engineering Examiners, reports that his state does not offer reciprocal registration with California, since California does not recognize Idaho licenses or examinations. Applicants from other states must take the Idaho examination for engineers unless the applicant can meet the qualifications of the law and the Board. However, as a matter of practice, the Idaho board licenses most applicants who have been licensed in another state by written examination, with the exception of California. The Idaho code specifically provides for reciprocal registration with a fee of $25. Except for Federal employees, it

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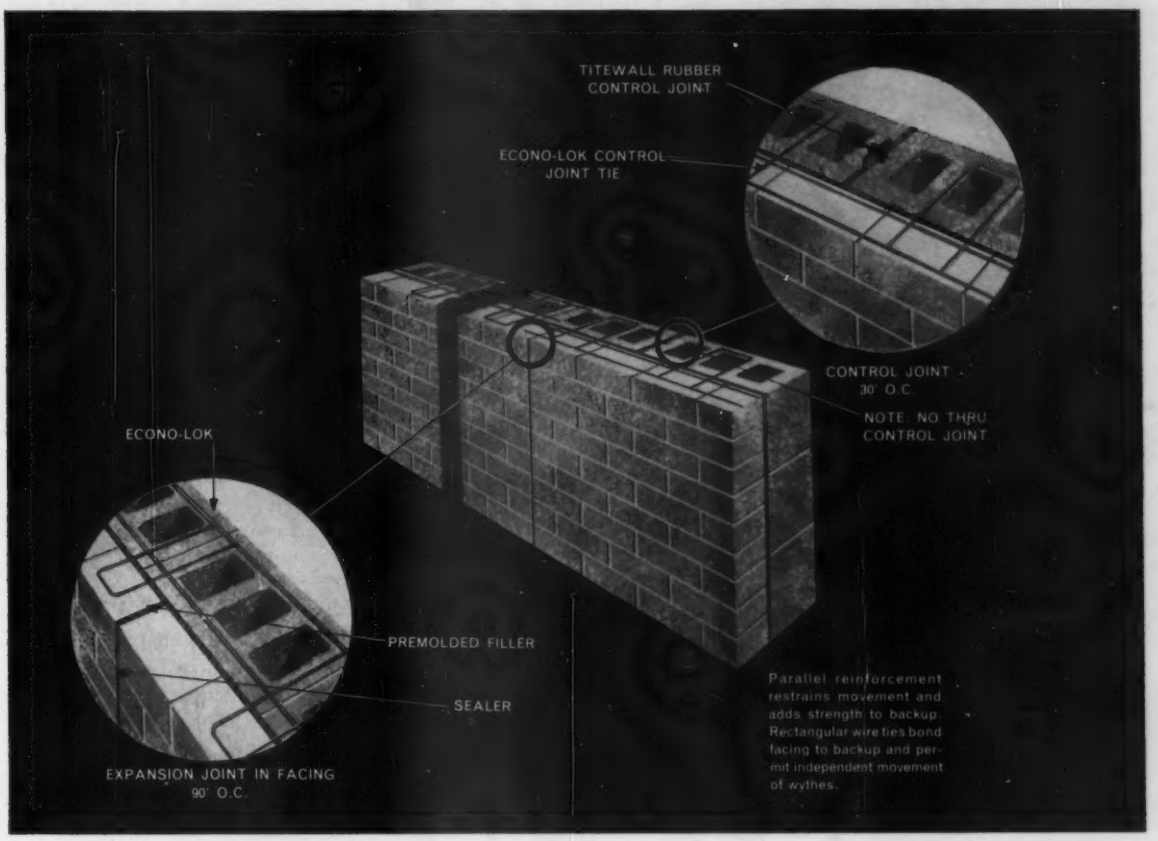
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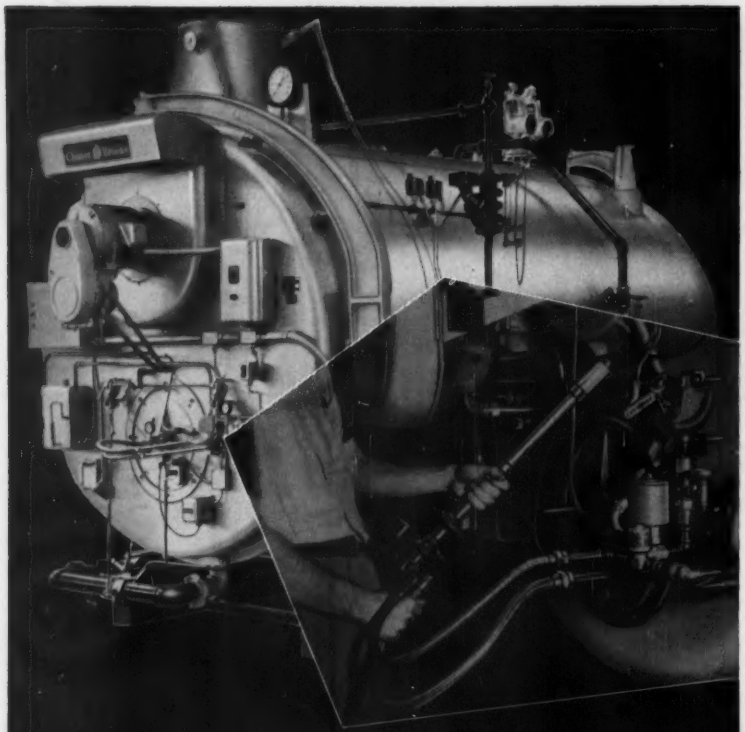


THIS BURNER NOZZLE CAN BE

pulled and replaced in 40 seconds!

On both oil-fired and gas-fired CB packaged boilers, an integral burner puts you money ahead with clean, economical combustion

The photo above shows how easy it is to withdraw the retractable nozzle from the boiler without removing bolts or opening the front head. The whole job takes less than a minute. That's just one of the features of the remarkable integral burner in every Cleaver-Brooks packaged boiler.

The Cleaver-Brooks air-atomizing oil burner atomizes and burns fuel oils (even #6) with low pressure air. Nozzle design determines degree of atomization. No further adjustment is necessary to produce high CO_2. Spray pattern of oil forms at a uniform angle — axial with the furnace — eliminating carbon build-up. Controls on the CB boiler regulate oil viscosity and pressure to the oil-metering valve. Air and fuel are mixed to the right proportions for high combustion efficiency. Burner nozzle and piping are purged on each cycle.

A word about gas firing:
The gas burner on gas-fired CB boilers offers the same well-engineered design. Gas burner on even the largest CB boilers requires less than a pound of gas pressure to operate — an advantage when gas supply pressure is low. You can also select combination burners—quick change-over from oil to gas or reverse.

Write for more information today. Packaged fire tube boilers — sizes through 600 hp for steam or hot water. In larger capacities, Cleaver-Brooks offers Springfield packaged and field-erected water tube boilers. Cleaver-Brooks Company, Dept. D, 321 East Keefe Ave., Milwaukee 12, Wisconsin.

Cleaver Brooks®
ORIGINATOR AND LARGEST PRODUCER OF PACKAGED BOILERS

is unlawful for any person in the state to use the title "engineer" unless he is licensed as an engineer.

John H. Bliss, of the New Mexico Board of Registration, advises that qualifications for out-of-state applicants are the same as for those in the state. The general requirements for registration under Section 13 of the New Mexico Code provide for graduation from an approved engineering curriculum of four years or more and a record of an additional four years or more of experience in engineering work satisfactory to the board. It also calls for two written examinations prescribed by the board and an oral examination. With the passage of the 1957 Act, out-of-state applicants can be registered by reciprocity if they have taken a written examination in the state in which they were previously registered and can show proof thereof. Written examinations may be waived in favor of an oral examination and interview if the applicant has had at least 24 years of progressive, qualified experience.

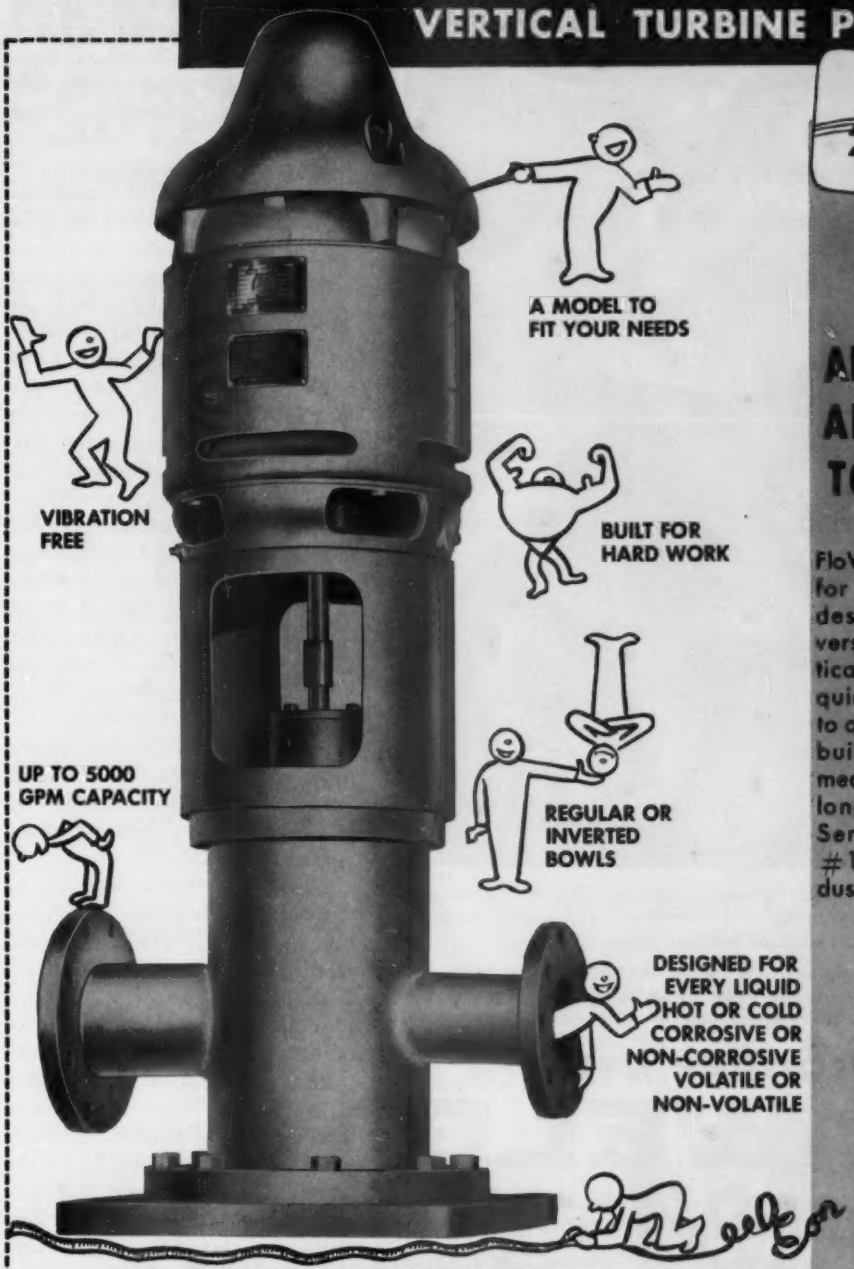
Require Personal Interview

A. J. Shaver, the chairman of the Nevada State Board of Registered Professional Engineers, points out that his Board has the discretion of offering an applicant either an oral or written examination, depending on his training and background, but in either event the applicant's appearance before the board is required. "We do not have full reciprocity with any state," said Shaver, "but we do acknowledge other states' registration, particulary if the applicant was registered upon written examination in that state."

Paul D. Christerson, secretary of the State of Oregon Board of Engineering Examiners, commenting on reciprocal registration, said, "This Board generally recognizes the registration certificate of a candidate who is licensed as a result of passing a written examination equivalent to those given in Ore-

VERTICAL TURBINE PUMPS

FLOWAY
formerly SMITHway


A MODEL TO FIT YOUR NEEDS
VIBRATION FREE
BUILT FOR HARD WORK
UP TO 5000 GPM CAPACITY
REGULAR OR INVERTED BOWLS
DESIGNED FOR EVERY LIQUID HOT OR COLD CORROSIVE OR NON-CORROSIVE VOLATILE OR NON-VOLATILE

ALL THIS— AND ECONOMY, TOO!

FloWay pumps are engineered for industry. In materials, design, construction, and versatility, they satisfy practically every industrial requirement. And in addition to obvious features, there is a built-in ruggedness that means low maintenance and long, economical service. Send coupon for Bulletin #14 describing FloWay industrial pumps.

NO SPRAWLING . . . TAKES LESS THAN 10% OF SPACE USED BY HORIZONTAL PUMPS

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Gentlemen:
Please send at once FloWay Bulletin #14

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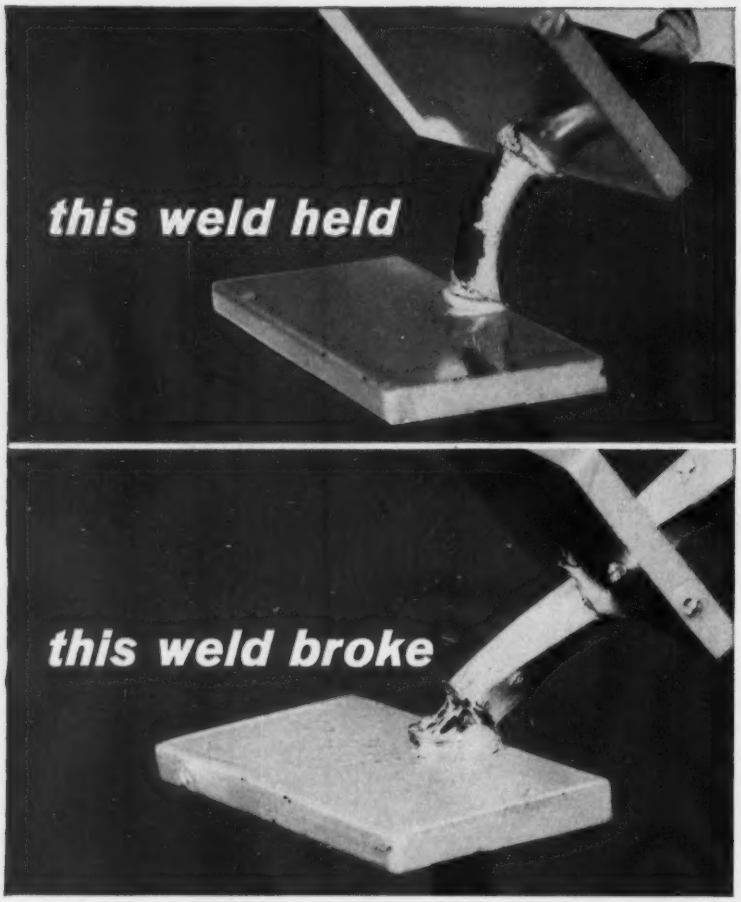
Address.....

City.....:State.....



(Above) This DRAVO TRU-WELD GRATING was deliberately bent, placing far more strain on the welds than there would be in normal service. Not a single weld has parted. This grating will withstand vibration and hard usage.

(Below) **Bent in exactly the same way,** this grating came apart at the welds. The fusion of bearing bar to cross bar achieved by the Dravo method of manufacture prevents this from happening to Tru-Weld Grating.

the new stronger grating is

TRU-WELD

Tru-Weld grating is stronger because it is *made* that way. Its added strength comes from a manufacturing process that completely fuses the metal at cross bar-bearing bar joints and holds the bars to exact spacing. The result is grating that stands up under excessive vibration, heavy traffic or in areas where corrosive fumes and moisture are a problem. And Dravo Tru-Weld grating *costs no more.*

Complete estimating, layout and fabricating services are available. Immediate delivery from stocks maintained at nearby Joseph T. Ryerson Service Centers will help you meet exacting construction schedules.

For more information on this new, stronger grating — call the Dravo representative in your area, or write Dravo Corporation, Pittsburgh 25, Pa.

DRAVO
CORPORATION

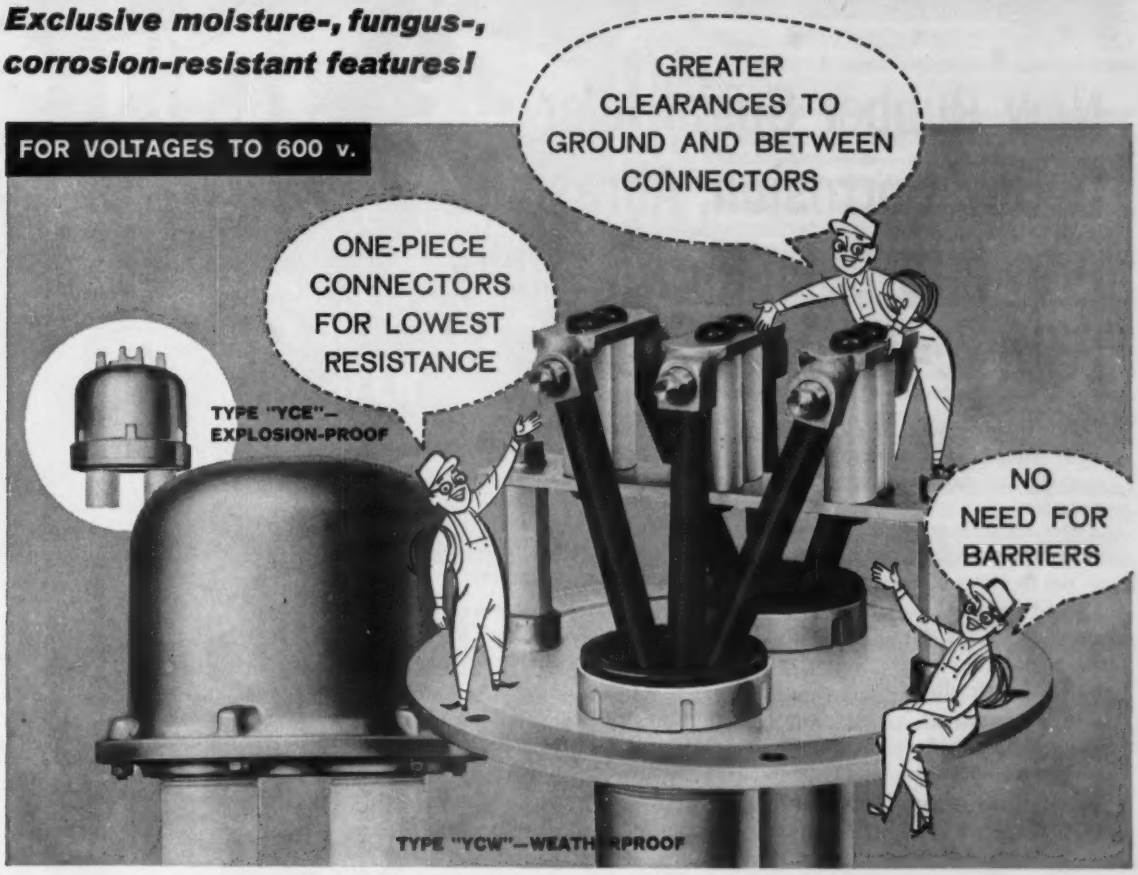
gon. To those who were registered by other means, such as the grandfather's clause, the Board will grant reciprocal registration if the applicant's qualifications are such that he would have been registered in a similar manner in this state."

On the question of mandatory registration of engineers in various categories, Christerson advised that persons receiving the approval of the Board for registration are licensed as professional engineers especially qualified in a given branch. The branches recognized include, but are not necessarily limited to, aeronautical, agricultural, chemical, civil, structural, electrical, industrial, logging, mechanical, mining, naval architect, and marine engineering. In addition to an examination in fundamentals, an applicant is examined in his branch of engineering, and it is in this category that he is "especially qualified." His practice is not limited to this branch, but it is expected that he will operate in fields in which he is competent. A person must be registered to engage in private practice of engineering regardless of category.

Edward C. Dohm, secretary of the Washington Board of Registration for Professional Engineers and Land Surveyors, reported that the Washington board may, upon application and the payment of a fee of $15, issue a certificate without further examination as a professional engineer or land surveyor to any person who holds a certificate of qualification of registration issued to him following examination by any state, territory, the District of Columbia, or a foreign country. However, it is stipulated that the applicant's qualifications must meet the requirements of registration in Washington; that the applicant be in good standing with the licensing agency in his state or country; and the state or foreign country must give like consideration to those persons who have been registered by examination in Washington. ▲▲

NEW! O.Z. PULL-N-SPLICE BOXES!
CONVENIENT·COMPACT·ECONOMICAL

Exclusive moisture-, fungus-, corrosion-resistant features!


FOR VOLTAGES TO 600 v.
GREATER CLEARANCES TO GROUND AND BETWEEN CONNECTORS
ONE-PIECE CONNECTORS FOR LOWEST RESISTANCE
TYPE "YCE"— EXPLOSION-PROOF
NO NEED FOR BARRIERS
TYPE "YCW"—WEATHERPROOF

O.Z. Pull-n-Splice Boxes mark a significant advance in pull box construction!

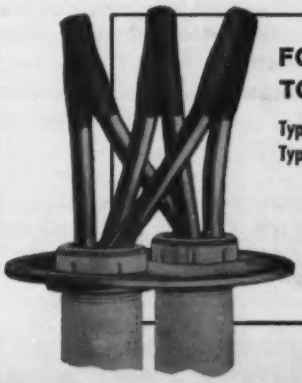
Their highly compact size saves *more space than ever!*

Their more efficient design means *new savings in installation time and labor!*

Their moisture-, fungus-, and corrosion-resistant features mean long, trouble-free service.

Still, with all their features, the new O.Z. Pull-n-Splice Boxes are *smaller* — and *cost far less* than conventional pull boxes . . . even late model *competitive* types! And, you get a bonus in high quality materials and workmanship so characteristic of *all* O.Z. products!

For complete information on these and the many other O.Z. products that mean more for you, call your local O.Z. distributor, or write to the company.



FOR VOLTAGES TO 5000 v.

Type "YPW" — Weatherproof
Type "YPE" — Explosion-proof

Deeper dome than "YCW" and "YCE". Furnished without connector panels. Insulated pigtail splices recommended.

O.Z. ELECTRICAL MANUFACTURING CO., INC.
262 BOND STREET • BROOKLYN 17, N. Y.

- CAST IRON BOXES
- CABLE TERMINATORS
- POWER CONNECTORS
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Any way you look at it...

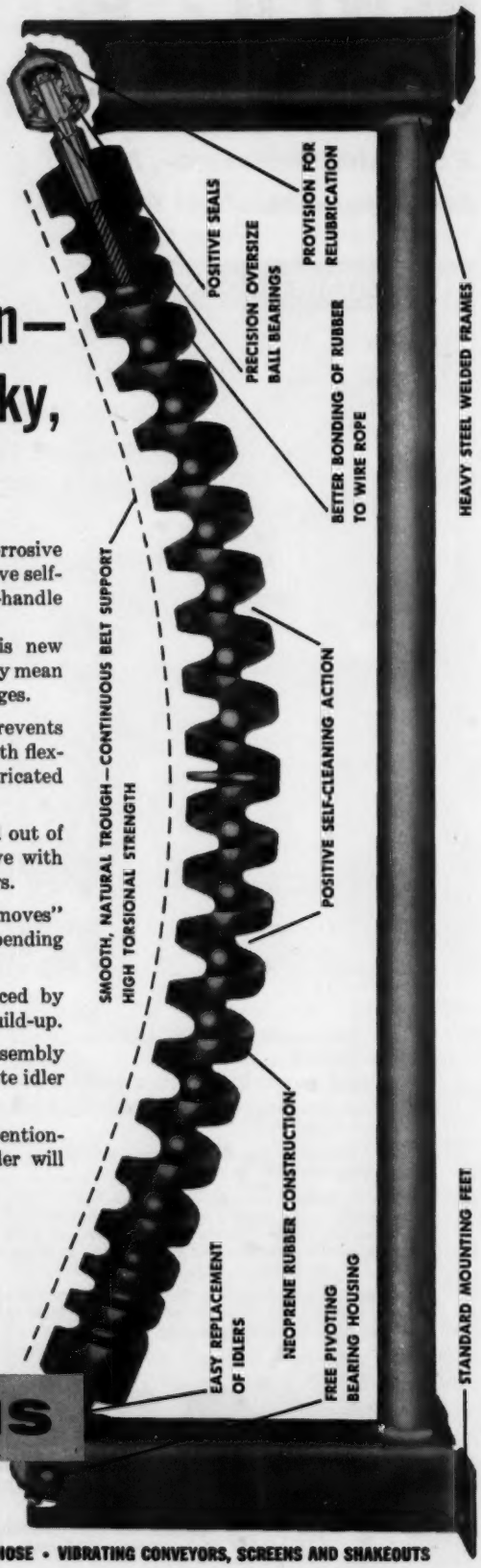
New Rubber Spiral Idler Defies Corrosion, Abrasion—Prevents Build-up of Sticky, Hard-to-Handle Materials

Here's the conveyor idler built to last longest in punishing corrosive atmosphere or extreme abrasive service! What's more, its exclusive self-cleaning rubber spiral prevents build-up of sticky, hard-to-handle materials!

The numerous design and construction advantages of this new Hewitt-Robins idler are shown in the illustration. Here's what they mean to you in terms of cost-cutting, time-saving, operating advantages.

- **LONG LIFE.** Neoprene spiral, completely covering wire rope, prevents attack in corrosive atmosphere. Uninterrupted spiral gives smooth flexing, maximum strength. Precision sealed bearings can be relubricated for still longer life.
- **SELF CLEANING.** As the spiral turns, it "works" any material out of the grooves as they change shape. This action is most effective with sticky materials which tend to build up on common types of idlers.
- **CONTINUOUS BELT SUPPORT.** The new rubber spiral design "moves" along the entire width of the belt; therefore, pinching and sharp bending of the belt are eliminated.
- **SELF TRAINING.** Belt training problems are greatly reduced by readily conforming rubber spiral, and by elimination of material build-up.
- **EASY REPLACEMENT.** The spiral, wire rope, and bearing assembly simply lifts out of its brackets—no tools are needed. The complete idler fits standard conveyor stringers.
- **TRUE OPERATING ECONOMY.** Under conditions where conventional idlers fail prematurely, the Hewitt-Robins rubber spiral idler will pay for itself many times over.

Deliveries of this revolutionary new idler are now being made in 18, 24, 30, and 36 inch belt sizes. For further information check your H-R distributor, or write Hewitt-Robins, Stamford, Connecticut. Ask for Bulletin 4-13.



HR HEWITT-ROBINS

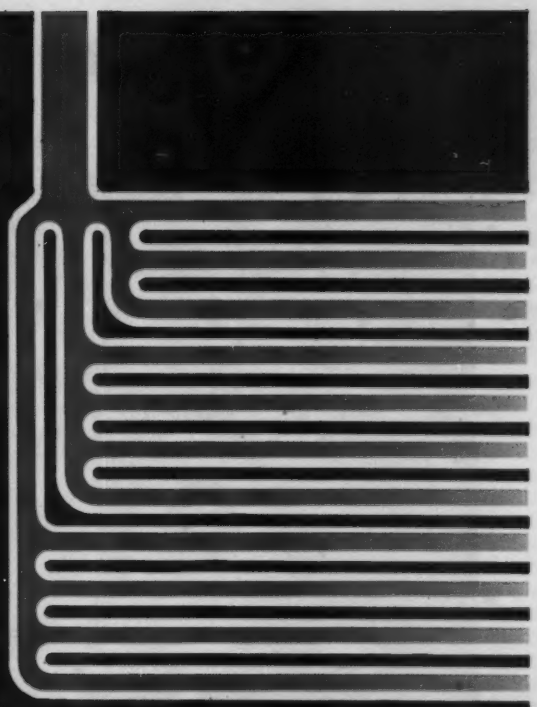
THE NAME THAT MEANS EVERYTHING IN BULK MATERIALS HANDLING SYSTEMS...

CONVEYOR BELTING AND IDLERS • POWER TRANSMISSION DRIVES • INDUSTRIAL HOSE • VIBRATING CONVEYORS, SCREENS AND SHAKEOUTS

NEW MULTI-ZONE

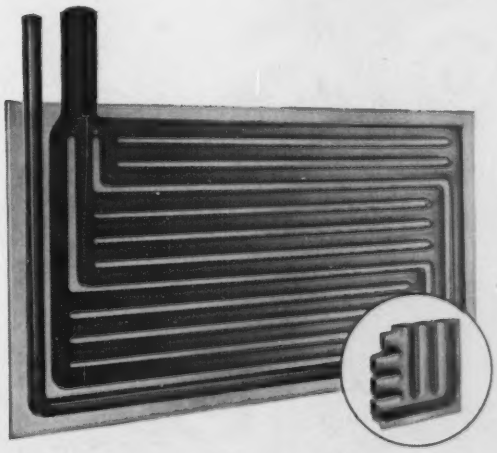
PLATECOIL®

IS AN EXCLUSIVE TRANTER ADVANCEMENT IN HEAT TRANSFER TECHNOLOGY



The new MULTI-ZONE PLATECOIL introduces a new principle of coil design. The multiple header, multiple return pass arrangement produces FREE-FLO action. Steam is distributed to all levels of the coil almost instantaneously. This new design overcomes the problem of condensate "trapping" — a disadvantage of common pipe coils and single-headered units—that robs effective heat transfer area. Only TRANTER PLATECOIL offers the extra capacity of MULTI-ZONE heat distribution.

MULTI-ZONE PERFORMANCE SOLVES TOUGH TANK AND PROCESS HEATING PROBLEMS



Better steam distribution provides a reserve capacity for heat transfer to overcome overload conditions which drop tank and process vessel temperatures. Heat-up time after tank or processing equipment shut-down is cut to a minimum. Tank temperatures are maintained within closer limits and production is improved.

More effective heat transfer area and more heat transfer per square foot of area makes it possible to use fewer and more compact PLATECOIL units than is possible with other types of equipment. Valuable tank space is saved and the need for addition of new tanks to get higher production is often eliminated.

Add to these performance advantages, low cost of installation and operation, economical maintenance and scientific engineering for the best answer to your heat transfer problems.

Write for NEW Bulletin P85 for complete data.

Tranter Manufacturing, Inc.

LANSING 9, MICHIGAN

PLATECOIL® DIVISION

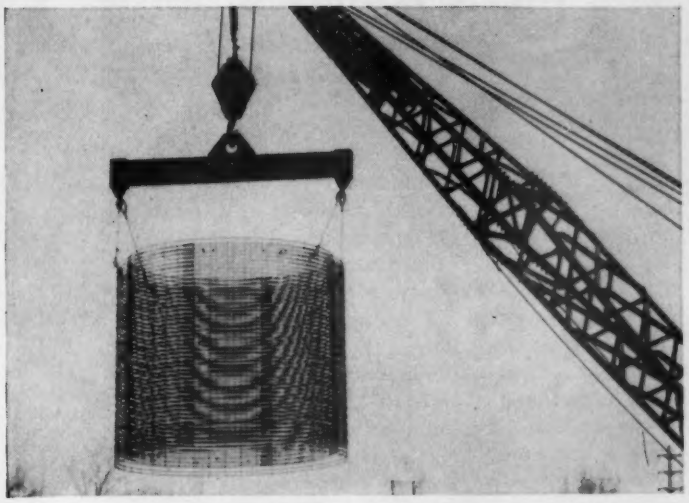
Reinforced Concrete Pipe specified for

The contractor was able to lay 15 to 20 sections of 8-foot pipe in 8-hour work shifts. This rapid progression indicates the exactness of the sections of concrete pipe furnished to the job. The contractor used care in keeping the trench walls vertical and narrow. Since the load-bearing capacity of the pipe is greatly influenced by the width of the trench, this type of installation is desirable and can be accomplished without special labor or equipment.

Visintine & Company and The Complete General Construction Co., Columbus, Ohio—Contractors

Price Brothers, Columbus, Ohio—Pipe Manufacturers

40-foot depth on Ohio Interstate Highway



The 2 cages of American Welded Wire Fabric are tied together at both the top and bottom with ¾" diameter stirrups. These stirrups increase the ultimate strength of the pipe and resist diagonal tension at top and bottom sections. If the circumferential steel were not accurately spaced, it would be difficult to place the stirrups in the positions required for best performance. This consideration, plus the over-all economy of using readily fabricated American Welded Wire Fabric, led to its selection.

Over-all view of the trench digging and pipe laying operations. You will notice that the 40-foot trench is open cut using a dragline down to the first level and then a back hoe to the 40-foot level. This sequence of operations enabled the trenching operation to proceed very rapidly. The back hoe digging the final trench provided the extremely straight and narrow trench for best installation.

In Columbus, Ohio, work is progressing on one leg of the important new North-South Freeway. 96" dia. reinforced concrete pipe was specified for a 40-foot depth installation. This was included in one of the largest contracts ever let by the state of Ohio.

The state of Ohio special specifications were followed and each phase of the pipe manufacture and installation was inspected by representatives of the state. The pipe was required to withstand 24,000 # per ft. for the 0.01" crack, and 32,000 # per ft. for the ultimate strength. The actual three-edge bearing test results showed the pipe passed these requirements with flying colors. The 0.01" crack did not appear until 26,000 # per ft., and the ultimate was not reached until the load reached 39,200 # per ft.

Produced by Price Brothers, Columbus, Ohio, the 8-foot sections of pipe with an 8½" wall of 5,000-lb. concrete, were constructed with two reinforcing cages of USS American Welded Wire Fabric. The outside cage is style 2" x 8"—0.4375" x 5 gauge and the inside cage is style 2" x 8"—0.505" x 5 gauge. More than 400 stirrups were positioned between the fabric cages for each 8-foot section to increase the resistance to diagonal tension and improve the pipe's ultimate strength.

The production of concrete pipe is closely controlled and numerous tests are conducted to assure design strength. High quality reinforcing steel is an essential ingredient for top-quality pipe. That is why USS American Welded Wire Fabric was chosen to reinforce the concrete pipe for this job. It is machine-made by electrically welding high tensile strength steel wires made to exacting specifications. The guaranteed minimum yield point is 60,000 psi and the guaranteed ultimate strength is 75,000 psi. All members are spaced to the close tolerances of plus or minus ¼" on centers. Because of the accurate machine prefabrication of USS American Welded Wire Fabric the two concentric cages can be formed faster.

Complete technical information on USS American Welded Wire Fabric is available. Just write to American Steel & Wire, Dept. 0164, 614 Superior Avenue, N.W., Cleveland 13, Ohio.

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American Steel & Wire Division of United States Steel

USS

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors
Tennessee Coal & Iron Division, Fairfield, Ala., Southern Distributors
United States Steel Export Company, Distributors Abroad

NSPE At Wichita . . .

Engineering Cost Survey Decisions on Ethics

AT A RECENT MEETING of the National Society of Professional Engineers, summary results of a survey designed to get comparable costs of private practice and government design were announced.

Five conclusions drawn from the information assembled by the NSPE Task Force are:

¶ The average fees of private consultants are considerably lower than the figures widely publicized.

¶ A common erroneous assumption is that the consulting engineer always receives a maximum fee based on a percentage of construction costs.

¶ It is impractical to generalize on engineering fees as a function of construction cost for a specific project. Lump sum fees are generally more equitable to the government and to the engineer.

¶ By using private consulting engineers, the public pays for the services only when needed.

¶ Private consulting engineers, motivated by a profit desire, constantly strive to minimize overhead and can adjust more quickly to changes in conditions.

In surveying government projects with a total of more than $4.3 billion in construction costs, the NSPE Task Force found that the average fee for design was 2.95. Individual fees ranged from 0.5 to 14.7 percent, the report stated.

Engineering inspection services on projects totaling more than $495 million averaged only 2.19 percent. Individual fees varied from 0.5 to 7.5 percent of construction cost.

For comparison, the report was forced to use incompatible government figures at least six years old. "A Hoover Commission Task Force report in 1955 found engineering service costs supplied by Federal agencies ranging from 5.23 to 17.8 percent. The lower percentages applied to agencies making greatest use of private consulting engineers." The NSPE report suggested that Congress should extend and up-date the 1955 [Hoover Commission] Task Force study to show the current costs of engineering services by governmental agencies.

Among its recommendations the report stated, "Governmental agencies should be responsible for preliminary study, preplanning, and budgeting, and essential supervisory management and control, with private consulting engineers handling design and other engineering services to the extent consistent with the public interest."

Later, a vaguer joint statement was issued by the Functional Section for Consulting Engineers in Private Practice and the Functional Section for Engineers in Government Practice:

"Governmental agencies should contract for engineering services with highly qualified private engineering consultants to the extent consistent with national security, proper continuity of governmental programs, and the public interest. NSPE further reaffirms its traditionally stated position that engineers in government and private practice recognize a need for engineering activities of a complementary nature."

More to the point was a statement from the Consulting Engineers Functional Section in regard to the Comptroller General's statement that "If all required engineering services were performed by the respective state highway departments, there would be no element of profit in highway engineering costs, and, by regulation, state highway department overhead is not a highway cost eligible for Federal participation."

The Functionals said, "The evaluation of costs for highway design should relate the cost to the public whether disbursed by the Federal government or a state agency. The proper basis for evaluation is that most beneficial to the taxpayer."

The Functional Section also endorsed, in principle, the recent resolution of the American Road Builders' Association recommending a uniform system of accounting for highway department engineering costs, prequalification of private consulting engineers as a condition to their use on Federal-aided projects, and clarification of present law on the use of consulting firms on Federal-aided highway projects.

Ethics Decisions

NSPE's Board of Ethical Review also has announced decisions on the ethics of advertising of engineering services; supplanting another consulting engineer on a project; and some of the finer points of specification writing.

Ads from telephone directories, newspapers, and trade magazines were discussed. The Board studied an ad that stated, "We may be able to save YOU future worries and needless expense through proper Design and Supervision of Construction." This is, according to the Board, "boastful, self-laudatory, and implies that the firm can render a professional service not available from others . . . The quoted language is not a statement of fact but rather a claim."

A newspaper ad taken to the Board said, "We are proud to have contributed our engineering services . . . " and listed a project or two. This was termed objection-

Motors and Generators....that's our Business!

can do!

During your next planning pow-wow on a forthcoming project, consider this challenge (ME* Can Do!) from a tribe of "Injun-eers" who make motors and generators their only business . . . and who have been successfully conducting this business on product merit for nearly 50 years.

Feathers in our bonnet include some of the world's most honored projects and our scalp belt includes a multitude of the leading names in industry, but the Chiefs at ME* are more interested now in what ME* can do . . . for you!

Wherever you are, whatever your requirements, there's an ME* Sales Engineer ready to visit your reservation, sit in at your council fire and discuss your requirements . . . help you with your planning . . . prove the superiority of Marathon Electric Motors and Generators.

This data and specification file on Marathon Electric Motors and Generators is now available for your ready reference use. May we mail you your free copy now?

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MANUFACTURING CORPORATION

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Offices in Principal Cities

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Automatic Bag Type Dust Arresters

For efficient low-cost dust and fume collection for years to come

With Norblo automatic cyclic bag shaking and cleaning, the fume or dust filtering capacity of the multiple cylindrical bag system is maintained continuously at high levels. The cleaning cycle lasts only a few seconds for each compartment — only three or four minutes out of each hour for *an entire unit.*

Thus Norblo Automatic Bag Type Fume and Dust Collection provides low-cost, continuous heavy duty service of high efficiency. Sound engineering design, almost fifty years' experience, and complete fabrication in Norblo shops assure you guaranteed performance at low operating and maintenance costs. Ask your consultant or write for Bulletin 164.

buell Norblo

Buell Engineering Company, Inc.
Northern Blower Division
6409 Barberton Ave., Cleveland 2, Ohio • OLympic 1-1300

able for the same reasons. However, the Board added that the advertisement would have been all right if the wording had been, "We have furnished engineering services in connection with the following projects in this city." In other words; if the firm had not been "proud" of its work, all would have been ethical.

The advertisement also used the slogan, "Progress Through Engineering is Our Only Product." The Board did not complain because this was a theft of General Electric's slogan, but because engineering is not a *product*. The Board said, "Engineering Is Our Only Service" would have been acceptable. The ethics of copywriting, it seems, can get quite complicated. Who is to separate bad taste from bad ethics?

The disputed advertisement in a trade magazine was a different and more serious matter. A manufacturer had featured the name and picture of a consulting engineer and one of his projects. The Board decided that "by allowing the use of the name of the engineering firm, the firm has accepted a benefit from the manufacturer which might tend to influence its impartial judgment in future engagements." And, "The practice of using pictures of firm members under these circumstances also raises a question of propriety and dignity." This is a good, and more important decision. Perhaps it should be enforced.

Supplanting Another Engineer

Next came a hypothetical problem:

"Engineer A had been retained by an Owner for certain engineering services under written agreement. Prior to the completion of his work, A was notified by the Owner that his services were being terminated. Subsequently, Engineer B was retained by the Owner for the same work. Engineer B was notified by Engineer A that the termination of his services was by unilateral action of the Own-

KENNEDIZED DISCS INCREASE VALVE SERVICE LIFE BEYOND COMPARISON

KENALLOY STEM

Exclusive KENNEDY alloy that practically eliminates dezincification and corrosion and provides smooth, non-galling threads and bearing surfaces. This stem easily withstood constant mechanical 18 foot-pounds closing torque and after 25,000 cycles was like new.

PACKING

New type packing made of molded graphite asbestos with a Buna "N" binder required no replacement during or after 25,000 cycles.

NO GALLING

KENALLOY stem showed no galling at this important bearing point.

STEM THREADS

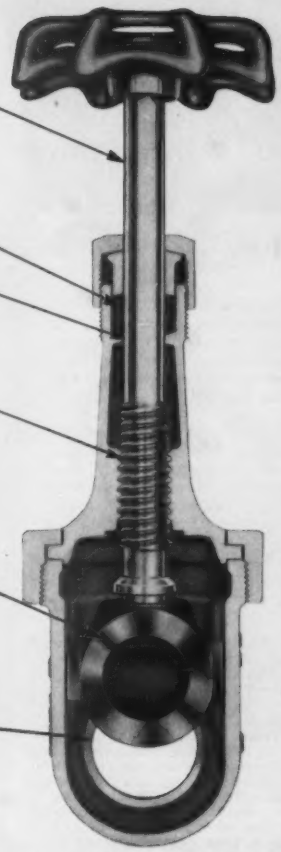
Only very slight wear and no galling were found on KENALLOY stem threads after complete tests.

KENNEDIZED DISC

The super mirror finish of KENNEDIZED disc actually improved with wear. Disc showed no galling or other wear marks after 25,000 cycles at 150 lbs. saturated steam pressure. This remarkable wear resistance is combined with an extremely low coefficient of friction, smooth sliding properties, excellent anti-seizure characteristics and corrosion and galling resistance. Tests proved these discs set a new and unmatched high standard in valve performance.

SEAT

The action of the KENNEDIZED disc was to place a high glaze finish on the seat. The low coefficient of friction and smooth sliding properties of the disc actually improved the finish on the seat. Here, again, no galling was found on the seat after 25,000 cycles.



Simply stated, KENNEDIZED is a special process that appreciably improves performance and increases life of metal wear parts. This is accomplished by increasing surface hardness, lowering the coefficient of friction and augmenting the resistance of base metal to corrosion and galling.

The process involves the deposit of a high chromium alloy which reproduces the original surface finish and contour of the base material, with no distortion of the parts processed.

This exclusive process, incorporated on KENNEDIZED discs, provides these highly desirable bearing properties:

1. Remarkable wear resistance.
2. Smooth sliding properties.
3. Extremely low coefficient of friction.
4. Unsurpassed anti-seizure characteristics.
5. Corrosion and galling resistance.

These characteristics were verified by a unique punishment test involving mechanical opening and hard closing of valves in operating service throughout 25,000 cycles. Details of test and complete valve structure are contained in Bulletin 574.

Fig. 525 KD
125-Pound S.W.P. Bronze Gate Valve

KENNEDY DISCS *NOW AVAILABLE* IN THESE KENNEDY VALVES

125-Pound S.W.P. BRONZE GATE VALVE

Non-Rising Stem, Inside Screw. KENNEDIZED Wedge Disc. Working Pressures: Saturated Steam, 125 lbs. W.O.G., Non-Shock, 200 lbs.

Fig. 427 KD

125-Pound S.W.P. BRONZE GATE VALVE

Union Bonnet, Rising Stem Inside Screw, KENNEDIZED Wedge Disc. Working Pressures: Saturated Steam, 125 lbs. W.O.G., Non-Shock, 200 lbs.

Fig. 325KD

200-Pound S.W.P. 550°F. BRONZE GATE VALVE

Rising Stem, Union Bonnet ¼"-2", Bolted Bonnet 2½"-3", KENNEDIZED Wedge Disc. Working Pressures: Steam at 550° F. 200 lbs., W.O.G., Non-Shock, 400 lbs.

Fig. 78 KD

300-Pound S.W.P. 550°F. BRONZE GATE VALVE

Rising Stem, Union Bonnet ¼"-2", Bolted Bonnet 2½"-3", KENNEDIZED Wedge Disc. Working Pressures: Steam at 550° F. 300 lbs., W.O.G., Non-Shock, 600 lbs.

Fig. 518 KD

• For complete details on KENNEDIZED DISCS write for Bulletin 574 or see your Industrial Distributor

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ELMIRA, NEW YORK

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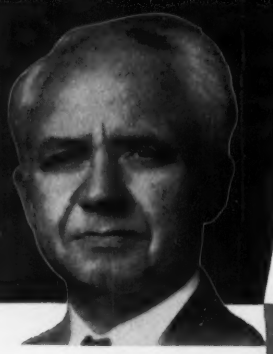
Highest Quality Water Filtration in large volume with SPARKLER DIATOMITE FILTERS!



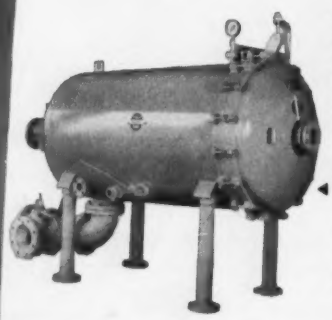
ALOYSIUS C. KRACKLAUER
Originator of the
Large Volume Diatomite Filter

Diatomite filtration of water in large volume is a comparatively recent development by Sparkler engineers. For many years the distinct superiority of diatomite filters in producing filtered water of highest clarity, with reduced bacteria count and with absolute uniform quality has been recognized by engineers in the chemical and other industrial fields, but old style diatomite filters were limited in volume.

Now the new large volume diatomite filters engineered by Sparkler have been tested in hundreds of successful installations in many industries and for municipal water supply, and have almost completely replaced sand filters for swimming pool filtration in schools, clubs, and municipal pools because of the greatly reduced chemical treatment necessary, to produce safe water.

This new phase of water filtration is worthy of careful investigation and study by all consulting engineers who are engaged in large volume water filtration.

MODEL RJ



A closed tank, pressure filter, with self cleaning features. The spent diatomite cake is peeled off the plates with the exclusive Sparkler Hydro-Scraper knife edge pressure spray and is washed out of the tank through the sloping bottom drain. The complete cleaning operation including precoating and recirculating for clarity ready for resuming operation is less than 30 minutes; a completely new uncontaminated filter media is thus provided. Filter element and spray tubes have no metal to metal contact with tank, thus providing electrolytic protection. Fully automatic electronic operation can be furnished.

Capacities are available in a single unit for 1,500,000 gal. per 24 hr. operation.

Approximately ¼ the floor space is required by this filter as compared with a sand filter and the installed cost is ⅓ to ⅔ that of sand.

MODEL HCV

A vacuum type filter that operates with an open tank and with full visibility of filtering process at all times. Plates are plugged into a self sealing outlet manifold at the bottom of the tank. Cake is removed by flushing off with hose. Spent cake flows out the self draining bottom through a T on the inlet supply pipe. Filter elements have no metal to metal contact with tank, thus eliminating electrolytic action.

This filter is available in capacities up to 900,000 gal. per 24 hr. operation.

Both filters have synthetic cloth covered plates that are removable without bolts or fastenings.

Write for bulletins and engineering data on these filters.

SPARKLER FILTERS

SPARKLER MANUFACTURING CO.
CONROE, TEXAS, U.S.A.

Sparkler International Ltd., Manufacturing Plants at Leliegracht 9, Amsterdam, Holland; Toronto, Ontario, Canada; Italy and Australia

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er and was completely unacceptable to Engineer A.

"Was it ethical conduct on B's part to accept the contract in view of the unilateral termination of A's services without his consent, and over his objection?"

The Board said "Yes."

"Even should [sic] the Owner's decision be based on whim, caprice, and other unsound motivation, it does not alter his right to have the Engineer of his choice for the work. It is equally clear, of course, that the Engineer is entitled to proper compensation for the work he performed . . .

"Engineer B may ethically accept and perform the work for the owner, subject to the assumption that he was in no degree responsible for or a party to the Owner's decision . . ."

The dissenting opinion, however, pointed out that the problem stated was not hypothetical but based on an actual case. "Engineer A in the actual case stated that other engineers declined the employment B accepted. If, in fact, the contract was terminated by the Owner based on whim, caprice, or other unsound motivation, Engineer B was on 'swampy ethical ground' in accepting the assignment."

Specification Reviewed

The Board's third decision was based on a specification:

"The design of members and connections for any portions of the structure not indicated on the drawings shall be completed by the contractor. Such design shall conform to the requirements of the current issue of the Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings of the American Institute of Steel Construction. These design shop drawings shall be submitted for approval, before any material is fabricated. Subsequent to approval, no changes . . . shall be made by the contractor."

1. Does the specification indicate preferential treatment and restric-

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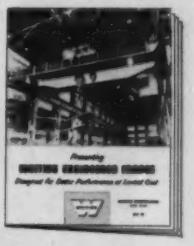
For example, here's a 55-ton Whiting gantry crane at work over one of the two largest generators in Florida. It is at the new Port Everglades plant of Florida Power & Light Company. To meet this company's needs, Whiting crane engineers developed a crane for outdoor standby service on big, costly generators, turbines, and auxiliary equipment. From power plants to steel mills, cranes of 5-ton capacity or 450-ton, a good choice is Whiting. Take 76 years of crane manufacturing, add a broad research and development program plus the talents of experienced engineers, and you have Whiting job-matched cranes—saving money across industry.



WRITE for information on Whiting Cranes . . . ask for Bulletin 80: *Whiting Corporation, 15620 Lathrop Avenue, Harvey, Illinois*

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tions of free competition among suppliers of building materials?

2. Does the specification encourage or suggest in any way the furnishing of free engineering services by the manufacturer of the building material?

The Board found that, "It has long been the practice for the designer to omit details of design where these are covered by well recognized standards and where the details vary widely among the several potential fabricators . . . Their (the specs') use places all fabricators on an equal basis and eliminates the unnecessary expense of preparing detailed drawings of portions of the structure which can be prepared more cheaply and with less confusion by the group responsible for the fabrication."

3. Should the consulting engineer do detailing work for contractors (fabricators and material vendors) on the same project for which he is engaged as the consulting engineer?

4. Should the consulting engineer solicit such detailing work on the basis of being the engineering consultant?

"It is not in keeping with the Canons and the Rules for an engineer to solicit or to execute work for a contractor, a manufacturer, or a supplier for items to be used in a project which he has designed, and on which he is still a representative of the owner."

5. Should the consulting engineer approve the materials and shop drawings of the fabricator for the project on which he is engaged as the consulting engineer?

"It is proper for a consulting engineer to approve materials and shop drawings of items and materials to be incorporated in a project which he has designed so long as his payment for such services are covered by his client contract."

Full Agenda

In other actions, the Functional Section for Consulting Engineers in Private Practice:

¶ Named L. M. Van Doren, of Topeka, chairman for the next administrative year starting July 1.

¶ Voted to continue free distribution of *Private Practice News* through the August issue, subject to a redetermination at the annual meeting.

¶ Authorized a new pamphlet to explain the background, purposes, and programs of the Functional Section.

¶ Agreed to a plan of the Task Force on Professional Liability Insurance to publish general information on previous liability cases and to compile complete data on liability cases for reference.

¶ Authorized continued NSPE support of the American Thrift Assembly in its efforts for passage of the Keogh-Simpson self-employed retirement bill in the current Congressional session.

¶ Announced there now are 24 state chapters. ▲▲

the V-notch

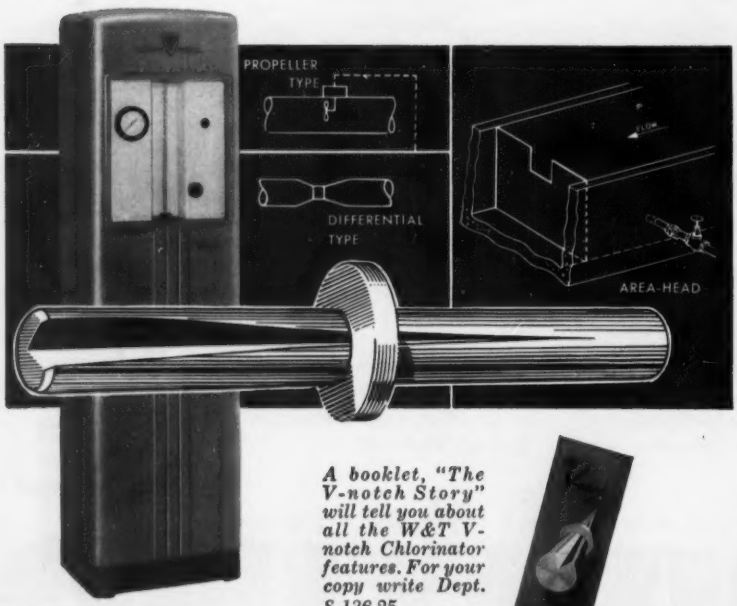
ready and waiting for your signal

Lots of jobs are done better automatically. Changing chlorine feed rate is now one of them. With the V-notch... the straight line metering action of the plug through the ring makes automation simple.

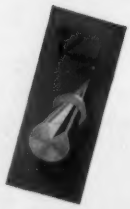
Merely by adding, not adapting, a W&T V-notch Chlorinator can give you any degree of automatic control you want—step rate, start-stop, program, proportional, even residual control.

With a V-notch Chlorinator any signal from any primary metering device can control chlorine feed. So anyone can afford automation.

And, of course, the right plastics make the whole chlorinator chlorine-proof.



A booklet, "The V-notch Story" will tell you about all the W&T V-notch Chlorinator features. For your copy write Dept. S-136.25



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Nurses Station

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Modular Units: Easy To Install

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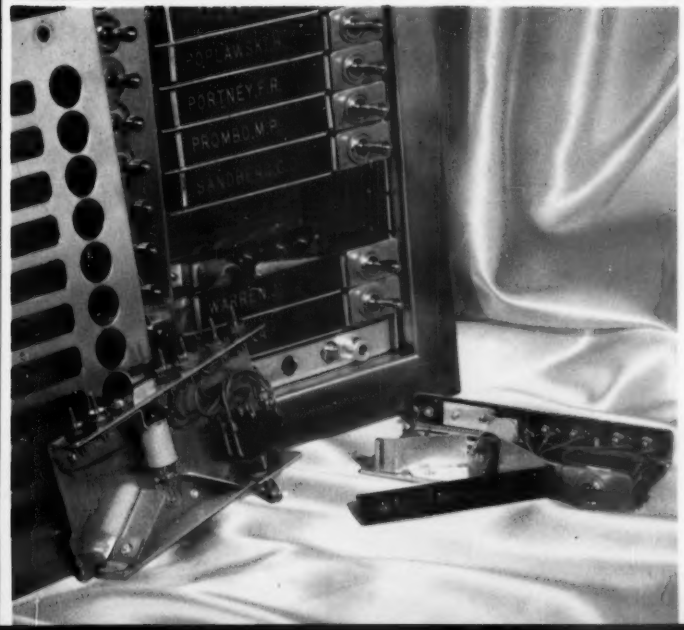

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Each nametile holder is a plug-in unit complete with nametile, lamp socket, reflector and switches as required . . . simplifies planning and installation of units tailored to specific requirements . . . with a wide selection of height-to-width ratios . . . of signaling procedures such as flashing lamps for message recall . . . flush, surface or special mounting . . . one of many units in the Couch line of hospital signaling systems.

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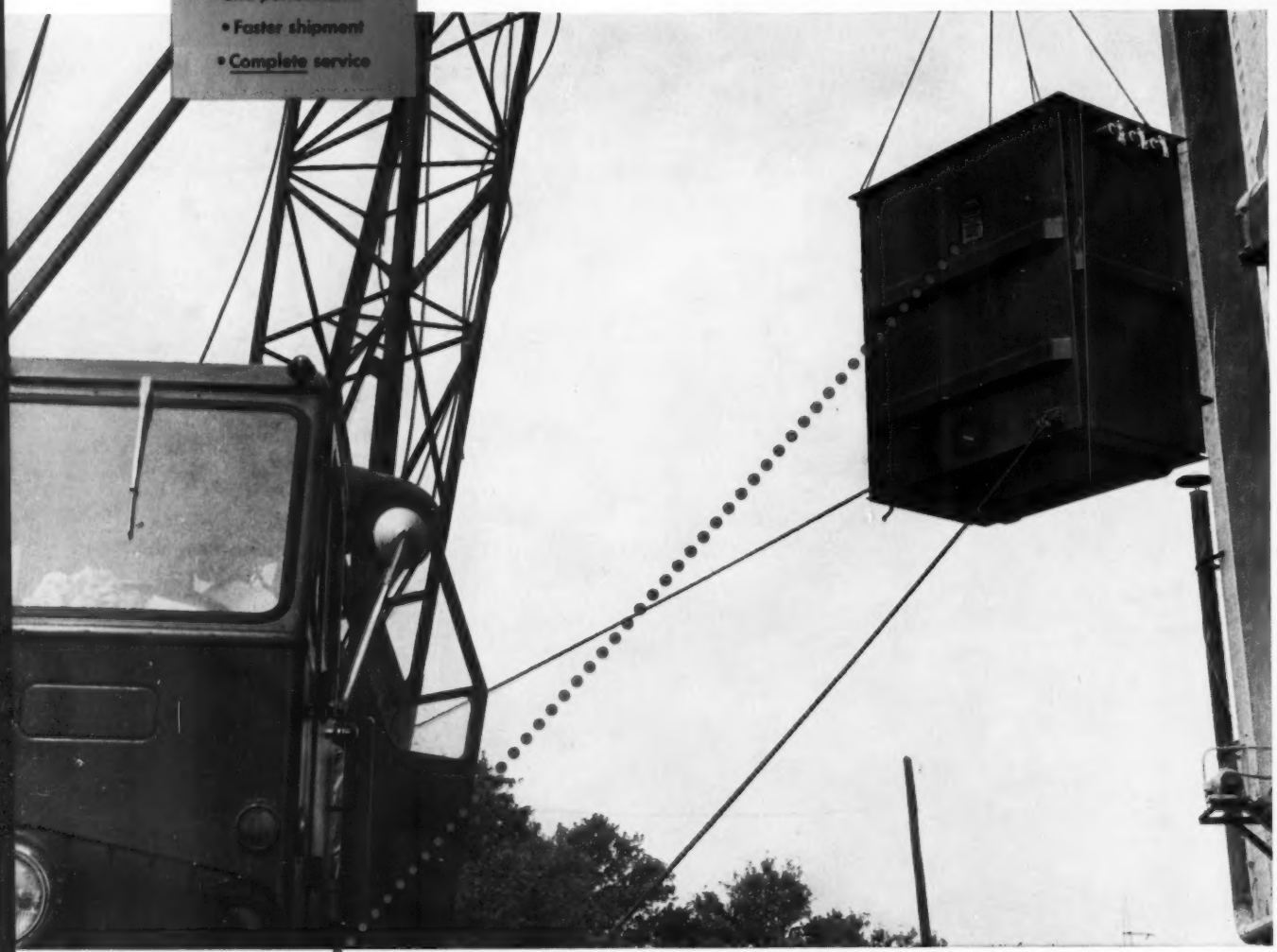

SYMBOL OF FULL VALUE

With this seal, General Electric certifies full value for your transformer dollar; full value in terms of superior basic design, features, and performance . . . plus faster order handling and shipment . . plus complete service before, during, and after installation. No other transformer manufacturer can match this complete General Electric package.

easier to install, maintain

General Electric dry-type transformers feature all-aluminum conductors, low sound levels, and superior insulation

Easier installation . . . safer, quieter operation . . . less maintenance . . . and longer life . . . all are features of General Electric's lighter full-value dry-type transformers.

Use of aluminum for all current-carrying parts has reduced weight up to *14 percent over previous designs!* This means simplified installation on roofs, catwalks, and other overhead locations. Sound levels meet or are lower than published standards. Transformers last far longer with exclusive Alpholite* insulation and added reliability is made possible by the higher impulse levels listed below:

Voltage Class (KV)	Impulse Levels (KV)
1.2	10
2.5	20
5.0	25
8.6	65
15.0	65

These important time- and money-saving features are yours with *every* General Electric dry-type transformer—open and sealed.

Minimum Maintenance

Maintenance is minimized with G-E dry-type transformers. Open-dry units—for indoor use—require only periodic cleaning of core and coil structure. Sealed units—ideal for dusty, dirty, or other contaminated atmospheres—need only an occasional exterior painting.

For information on full-value transformers, contact your G-E Apparatus Sales Engineer or Agent today. Write for GEA-6668 and GEA-6790. General Electric Co., Schenectady, N. Y.

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ALUMINUM CONDUCTORS in General Electric dry-type units reduce weight up to 14%.

ALPHOLITE INSULATION provides high dielectric barrier between windings.

GENERAL ELECTRIC'S FULL LINE of transformers includes sealed (left) and open-dry types, 300 kva and above.

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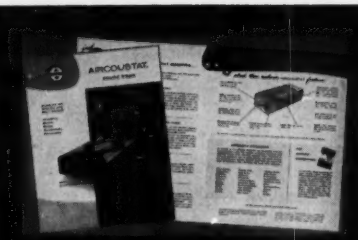
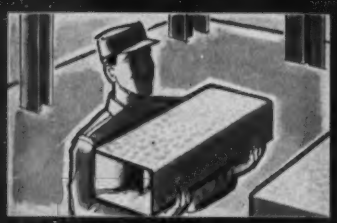
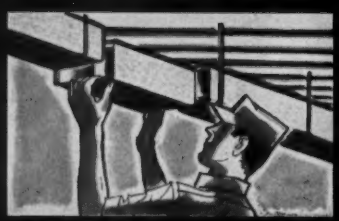
Sound Traps . . . with Guaranteed Results



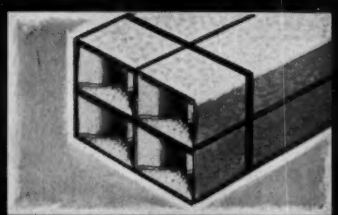
1) Easy to select—Just 3 steps to specify proper model. Save time, avoid errors.



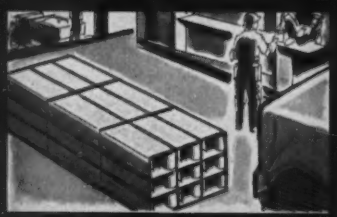
2) Easy to handle—No riggers or special equipment needed. Large units composed at job site.



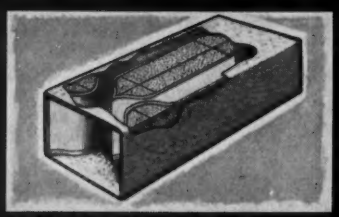
3) Easy to install—Units are installed the same as ductwork. Units have 2" extensions.



4) Fits all duct sizes—Big units are easily assembled from small Aircoustat units.



5) No storage problem—Units are delivered right to the job site, ready to install.



6) No maintenance—Units are fire-resistant, dust-proof and built to last a lifetime.

7) Guaranteed results—Solves every noise reduction problem. Units are completely reliable.

Pre-engineered by Koppers to eliminate guesswork, unnecessary calculations and difficult installations, AIRCOUSTAT Sound Traps guarantee trouble-free silencing of all duct-transmitted noise . . . at a savings in time and money to you.

AIRCOUSTAT selection is quick, simple and reliable. A choice of over 60 stock models, fabricated in 6 lengths, solves every noise reduction problem. AIRCOUSTAT is built to give a lifetime of maintenance-free service.

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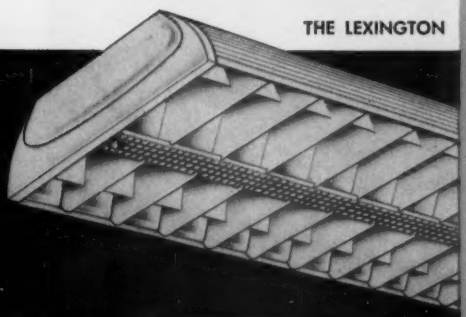
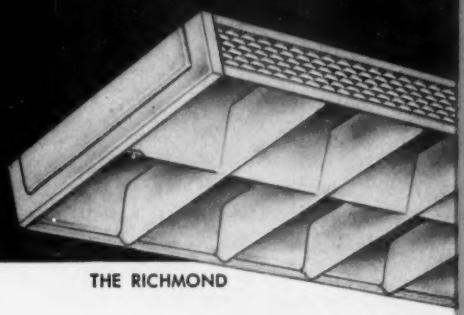
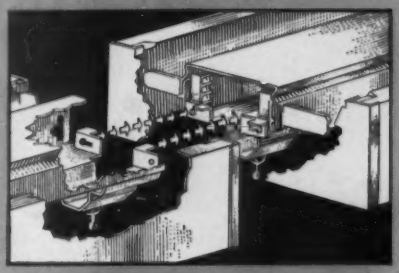


New Improved RICHMOND and LEXINGTON ...at New Low Prices



THE RICHMOND



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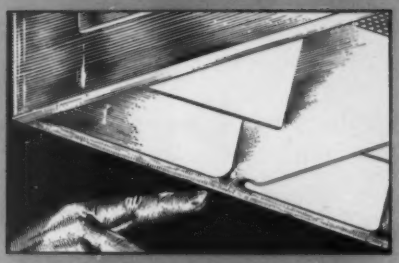

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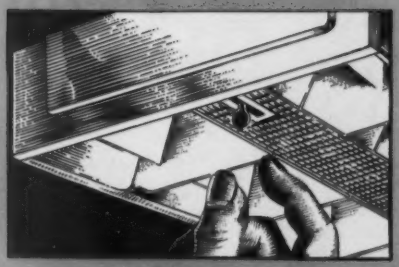

Sure Locking, Visual
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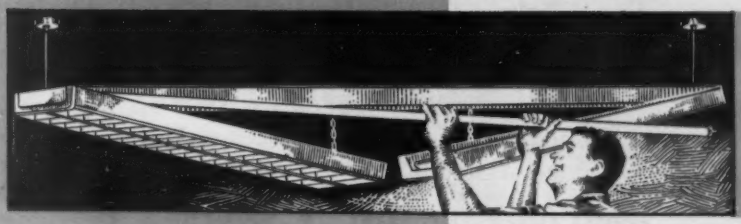

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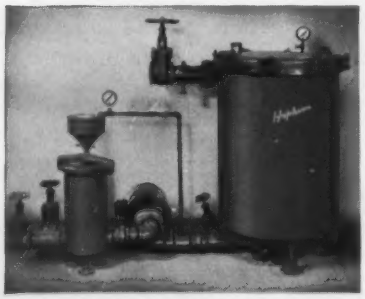

● Hopkins Model 32-22 Filtermaster with capacity up to 18,000 gals. per hr.

On Foreign Assignments . . . TCI Leaves Equipment Behind

RECENTLY His Excellency, The Minister of Communications of Thailand, requested Transportation Consultants, Inc., the Washington, D. C. firm of consulting engineers headed by General Lacey V. Murrow (October 1958 cover), to undertake a comprehensive evaluation of Thailand's transportation system requirements. Thailand wanted to know if it was feasible to establish a deep sea port; what it must do to maintain its strategic advantages in the jet age; to what extent and where highways should be improved; what transport facilities could best aid in the development of the economically depressed areas of Northeast Thailand; whether the inland waterways should be deepened – in short, wanted to know where each transportation dollar could be spent to the best advantage from the overall standpoint of comprehensive economic, social, military, and political development.

TCI sent to Bangkok a team of transportation engineers, plus a rate specialist, economists, draftsmen, and a computing staff. They traveled over 16,000 kilometers of primitive roads by truck, taking notes in the remote cities of Thign Song, Uboi Rat Thani, and Fang; they inspected the State Railways, from the historic bridge over the River Kwai to the terminal at Chiang Mai; they studied the air routes of Thai Airways and the ports and port cities on the Gulf of Thailand and the Andaman Sea.

Along with the men went the business machines for on-the-spot calculations, making data immediately usable. Then, in agreement with International Cooperation Administration, which sponsored the project, the machines and the skills to use them acquired by Thai personnel were left to become a useful part of Thailand's expanding economy.

This is typical of many of Murrow's projects, for the leaving behind of tools and skills is part of his philosophy.

As field offices are established, the TCI staff moves in, and recruits and trains the local personnel. The training provides not just for the use of business machines but for interpretation and use of the resultant data. In this way the local people are left much more than the completed project. They are left tools and skills they never had before. ▲▲

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YARWAY REMOTE LIQUID LEVEL INDICATOR GIVES BRIGHT, INSTANT, ACCURATE READINGS

On its brilliant "wide vision" dial you can clearly read the level from any point in a 180° arc—and from a considerable distance.

Remote readings of levels in boilers, feed water heaters and other heat exchangers are instant and accurate because indicator operating mechanism is actuated by the varying head of the liquid itself, yet the pointer mechanism is never under pressure.

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A record of nearly 13,000 successful installations speaks for itself.

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Admixtures... Fifth Ingredient For Concrete

STAFF REPORT

CONCRETE ADMIXTURES have been in use for over 30 years, and their history is probably as old as that of cement itself. In the first century A.D., Marcus Vitruvius Pollio, the famous Roman architect-engineer, recommended hog's lard, curdled milk, or blood in his formula for stucco. Any one or all of these may have caused air entrainment and an accompanying improvement in durability. However, it is reasonably certain that Vitruvius had no knowledge of why this stucco was better, and he made no effort to find out.

CE exclusive

Portland cement was patented in 1824, and in 1871 the first mill for its manufacture in the United States was erected. By 1885 studies were being made in the U.S. of the reaction of cement mixed with tallow and with clay. While these were additives (added at the mill), not admixtures (added at the mixer), they were the starting point for research by the cement industry which ultimately led to the discovery of the advantages of air entrainment in concrete. The full significance of this phenomena was not understood until the Portland Cement Association made a thorough study, in the late 1930s, in which experimental pavements were actually constructed. This led first to air entraining cement, and later to the generally accepted practice of adding air entraining agents at the mixer on the job or on the ready-mix truck.

Admixtures Gain Acceptance

Meanwhile, calcium chloride was being investigated because of its ability to accelerate set, particularly in cold weather. Other admixtures also were being studied, and by 1954, when the American Concrete Institute Committee 212 Report was published in expanded form, 11 different admixture classifications were discussed. Further status was given to the use of admixtures in the same year when the Bureau of Public Roads published its detailed report on the effects of air entraining admixtures and an approved list of suppliers. Then, in 1959, the American Society for Testing Materials sponsored a program covering water reducing and set retarding admixtures at its Third Pacific Area National Meeting.

All of these events bore testimony to the fact that admixtures were moving from the patent medicine shelf to the prescription drug department. Unfortunately, this was a long time coming, but perhaps rightly so. The early history of admixtures is littered with cure-all concoctions that were purported to do all things for all concrete. It was in this era that tall stories of flash set or failure to

set at all began to circulate. And while there was valid fault to be found with many an admixture, it was probably true that the major fault could be laid at the door of careless specification and lack of control of concrete mixtures. Gullible users of questionable admixtures were ignoring the fundamentals of good concrete design.

Today, the admixture business generally is conducted on a responsible level, primarily by men who are, by experience and training, good concrete engineers. The objective of the current crop of admixture producers is not to make bad concrete good, but to make good concrete better — by adapting it to meet some of the job conditions which are capable of making good concrete bad. Field men are available for engineering consultation, and performance claims are backed by sound laboratory and field testing. It is true that there still may be a large amount of calcium chloride disguised with a good trade name and a bright colored dye, but it is relatively easy for a competent engineer to decide which companies are offering reputable research and field experience to back up their claims.

Admixtures Require Tight Specifications

While all concrete authorities would not endorse the use of admixtures, a majority of them are now favorably inclined to one or more. However, one of the biggest problems facing the field of concrete production is indifference toward the design and control of concrete mixes. Often, performance specifications are established with little regard as to how the specifications are to be met in the field. This practice must be replaced by tight specifications and careful supervision of construction.

Engineers in various Federal and State departments are quite generally specifying admixtures when they find their use appropriate. Unfortunately many consulting engineers are ducking the responsibility, perhaps partly because consultants themselves are split into pro and anti-admixture factions. Those opposed to admixtures are to be commended for taking a position, but those who favor admixtures and then turn the whole matter over to the contractor, or even the producer, are failing to assume a basic responsibility.

J. J. White, chief specifications engineer of Parsons, Brinckerhoff, Quade & Douglas, points out that, "When a specification writer lacks the courage of his convictions, he seeks refuge behind the weasel-worded phrase 'or equal, as approved.' How does one determine that product B is the equal of A? By tests of physical or chemical properties? By controlled laboratory comparative tests, as in the case of water reducing-retarding admixtures, to determine its effect on concrete? But what assurance may the engineer have that such laboratory obtained results will be duplicated in the field where all sorts of variables in weather, materials, and workmanship commonly prevail?

"The specifications writer who understands the advantages to be gained from the use of a water reducing-retarder is expected to know which of the several types is best suited for the job under consideration, and he should specify that proprietary material outright as a so-called 'base-bid' feature. There may be some specifications writers fully versed in the chemistry of the various types of admixtures and thereby qualified to specify the formulation of the required product. But it is unlikely that there is such a man, outside the manufacturers' staff, and he certainly is not going to divulge any trade secrets.

"Not only is the material itself to be considered, but also the reputation and ability of the manufacturer to furnish prompt technical assistance when required in the field. Trade name is the answer. When job conditions are such as to require competition, the bidder can be offered the opportunity to submit with his proposal an alternate bid complete with supporting data and a statement of the amount of money to be added to or deducted from the base bid if the alternate be accepted.

"Frequently, after he has made up his mind as to type and trade name of the water reducing-retarder he considers best for his job purposes, the engineer finds himself faced with the problem of considering the contractor's request for approval

Manufacturer's representative checks admixture dispensing equipment installed in a batch plant.

Admixtures improved workability and ease of placement of concrete on California's Weldon Canyon Freeway.

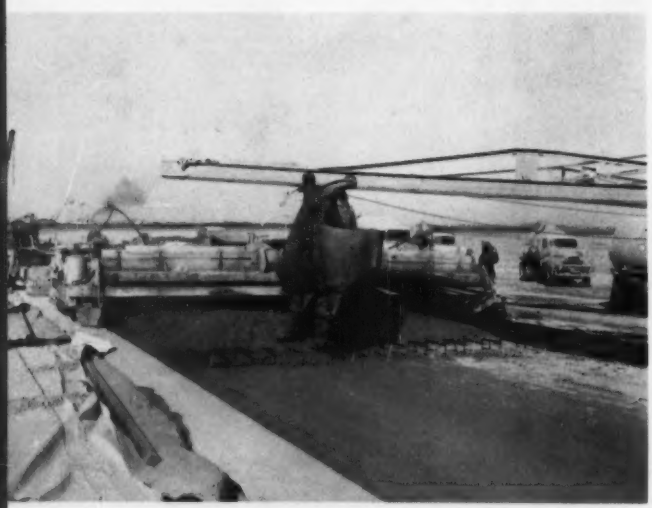
of a substitute. Unless the manufacturer of a competing product can successfully demonstrate the advantage of his product over the one specified, nothing is gained by granting such approval. The engineer who is well versed in the reasons for employing an admixture is in a solid position to state in clear and simple terms exactly what he wants and why he wants it."

Authorities Still Dispute Merits

Because of its past problems, the admixture field is subject to some rather adverse criticism. By the same token, it has some ardent supporters. At best, the attitude of most cement manufacturers is on the negative side because of past efforts of some admixture suppliers to encourage reduction of cement quantities by substitution of admixtures. However, one representative of a leading cement producer takes quite an objective view of the subject. He says, ". . . Past experience with admixtures indicates that their performance varies with cements used, pointing to the need of establishing their action with the concrete materials to be used on a particular job. For this reason, ready-mix concrete producers often will use an admixture only if so specified by the engineer or architect, and obviously place the responsibility for the resulting concrete on the architect or engineer. Also, there are no generally accepted specifications for the admixtures themselves, giving the buyer no opportunity to check for uniformity and performance of the product."

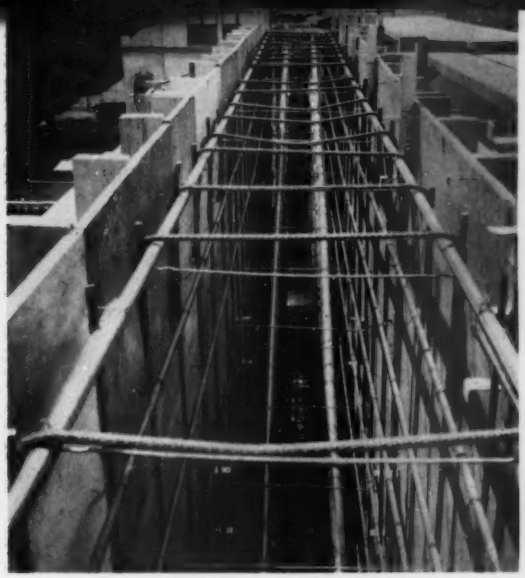
One consulting engineer, well known in the field of concrete design, takes a very strong negative stand toward admixtures. He bluntly states, "I have been of the fixed opinion, based upon research work being performed in the field of cement and concrete technology, that no admixtures except air entraining agents improve the quality of good concrete, and none of these mixtures can make bad concrete good." In direct contrast to this are the many published reports of construction work on which consultants have successfully specified admixtures.

The attitude of even the leading admixture manufacturers still is colored by their stormy past. For example, less than two years ago, one repre-



Work at the O'Hare Airport, Chicago, was completed ahead of the winter weather with the aid of admixtures.

Concrete set retarder used on the Rox River Section, Illinois Tollway, delayed set until full load was applied.



Admixtures were used in concrete mix for these girders in an art gallery to meet critical design requirements.

sentative of the industry in a talk to ready-mix concrete producers said, "Twenty or thirty years ago, if I had been asked to talk at all, I might have been tempted to wear a suit of armor or some other protection against the aggregate or other missiles that might be hurled at me in presuming to talk on such a subject. I just might have to duck now and then this morning." He evidently believed that the ready-mix men were a hostile audience, with little desire to add further complications to concrete batching. In view of the fact that one ready-mix plant is known to stock 14 admixtures, all supposedly water reducing agents, he probably was right in being apprehensive.

Surprisingly enough, one of the most enthusiastic endorsements of admixtures is contained in the ACI Committee 212 Report. In the introduction it is stated that, "The committee endorses the statement of P. H. Bates that 'the use of admixtures should not be frowned upon or scorned. On the contrary, their development and study should be highly commended and fostered.'"

Admixture Ingredients Identified

One of the big stumbling blocks in the way of a better understanding of admixtures was the lack of information about their chemical composition. The Committee 212 Report covers 11 classes of admixtures grouped on the basis of both the type of material and the characteristic effects of their use. The Bureau of Public Roads, in its study of air entraining admixtures, gives a detailed chemical history of all the materials which it used.

The BPR study reports on 27 materials submitted by 19 different producers. These were broken down into seven groups, with 7 admixtures classified as primarily salts of wood resins derived from pine wood stumps; 7 as synthetic detergents derived from petroleum; 4 as salts of sulfonated lignin from the paper pulp industry; 2 as salts of petroleum acids from petroleum refining; 2 as salts of proteinaceous materials from animal hide processing; 4 as fatty and resinous acids and their salts from paper pulp and vegetable oil processing; and one as organic salts of sulfonated hydrocarbons from petroleum refining.

Results Can Be Predicted

The principal advantage of this report, and others such as that conducted by the National Sand and Gravel and the National Ready Mixed Concrete Associations, lies in the fact that most admixtures are now fairly well identified chemically in the promotional literature. Thus, anyone interested in specifying admixtures has opportunity to study voluminous research data from independent sources as a guide in the evaluation of specific chemical types of admixtures.

For example, almost half of the admixtures offered by seven leading manufacturers are chemically identified, at least as far as the predominant active agent is concerned. Thus, while some of the effects claimed may result from small quantities of unidentified agents, the general effects can be evaluated against those reported for similar chemical agents in published independent research. While there is no established standard for individual admixtures, there is some basis for predicting their general effect on a specific concrete mix.

The Tigres Dam in the French Alps is one of many overseas projects where air entrained concrete is used.

Where feasible, test runs of the planned mix are, of course, the best basis for predicting results.

Admixture Use Continues to Grow

Even though between 70 and 75 percent of all concrete poured contained some admixture back in 1954, it would be unrealistic to claim universal acceptance for any admixtures except the air entraining agents. The use of calcium chloride in small quantities is recognized in both the Portland Cement Association's pamphlet on *Design and Control of Concrete Mixtures* and the ACI's 1959 Standards. While practice in the U.S. is rather conservative with regard to calcium chloride, the Russians use it generously, going as high as 11 percent by weight of the cement during cold weather. Of course, they do not use such concrete where freezing or thawing is a problem!

Currently, the water reducing and set retarding admixtures are getting increasing attention and acceptance. Thus, the growth of admixture use seems to be following an orderly development now that its unfortunate past is being gradually forgotten.

The engineer who, a few years ago, made the statement that, "The only good admixture for concrete is Portland cement," can no longer ignore hog's lard, curdled milk, and blood – they will not go away. ▲▲

Draft of an Office Guide Specification for an Admixture

Prepared by the Specifications Department of Parsons, Brinckerhoff, Quade & Douglas

This specification follows the "base bid" practice of prescribing a proprietary material, and offering the bidder the opportunity of submitting an alternate bid on any other type of retarding densifier.

CONCRETE

C6 – RETARDING DENSIFIER (proprietary trade name) ADMIXTURE

The retarding densifier shall be (proprietary trade name) as manufactured by (company name).

In general, the minimum amount of (proprietary trade name) to be used shall be in the proportion of ½ pound powder, or 2 ounces liquid, per bag of cement at ambient temperatures below 65° F; ¾ pound powder, or 3 ounces liquid, at temperatures from 65° F to 85° F; and 1 pound powder, or 4 ounces liquid, at temperatures above 85° F; except when the ingredients of concrete are heated, the concrete temperature shall govern the proportions to be used. Under exceptional hot or cold weather concreting conditions, or where exceptional retardation is needed for revibration or special quality concrete, the Engineer will direct amounts to be used.

The retarding densifier shall be a hydroxylated carboxylic acid compound and, when tested under approved laboratory conditions, shall have the following characteristics and secure the cited improvements in concrete containing the retarding-densifier, compared to reference concrete without the admixture, when used in the temperature-control proportions hereinbefore specified:

1. For equal water-cement ratio: Increase slump at least 50% and increase the compressive strength of the concrete at 28 days at least 10%.
2. For reduced water-cement ratio: Maintain slump and increase the compressive strength of the concrete at 28 days at least 15%.
3. For reduced water-cement ratio: Delay the setting time of concrete at least 20% under laboratory test temperature conditions.
4. For equal or reduced water-cement ratio: Increase the unit weight (density) of concrete.
5. Promote fast bleeding of clear water at the rate of at least 50% of the total volume of bleed water during the first hour of set.

The retarding densifier shall be a nonhygroscopic powder or concentrated liquid free from calcium chloride, foaming or air entraining agents.

NOTE 1: Only concrete so specified herein (in the Special Provisions) shall contain a retarding-densifier as an integral part of the design mix, and the cost thereof shall be included in the "base bid." At the option of the bidder an alternate bid for a substitute for the proprietary material specified herein may be submitted with the proposal, complete with supporting data and a copy of notarized results of comparative test reports made by a laboratory of recognized standing and provided further that such alternate bid stipulates the amount of money that is to be added to or subtracted from the base bid.

If the owner refuses to permit the use of a single trade name, the provisions for the alternate bid may have to be dropped and the lamentable clause "or equal, as approved by the Engineer" substituted therefor.

NOTE 2: For a so-called "open type of specification:

a. Add to the paragraph which names (proprietary trade name): "or equal, as approved by the Engineer."

b. Add the requirement: Documentary proof shall be submitted that the concrete containing the retarding densifier maintains strength increases over a period of at least two years, that drying shrinkage is reduced at least 10%, that uniformity in the mix is maintained and that an admixture of the exact composition proposed has been successfully employed in work of similar scope for at least 5 years. The Contractor shall submit a statement from the manufacturer of the retarding densifier certifying that his product conforms to these specifications in regard to performance and chemical limitation, with particular reference to unvarying uniformity of the admixture.

STAFF REPORT

Materials Handling

- A Controversial Field
- The Role of the Consultant
- Planning the New Plant
- Remodeling the Old Plant
- Special Problems
- Projects

MATERIALS HANDLING equipment sales for 1960 may top the estimated $2 billion mark established in 1957. And by 1965, $3 billion in sales is a possibility. Since materials handling systems are steadily growing more complex, it is obvious that an increasing share of these dollars must go to engineering – both product development and system design. The inclusion of system design engineering is no accident, for the sales figures for materials handling equipment include large sums for this service. Engineering is sometimes an obvious and separate charge, but more often it is quietly buried in the purchase price of the product.

However, in spite of the fact that materials handling sales figures conceal large engineering charges, the field is still attractive to many consulting engineers. In fact, there is little doubt that the role of the consulting engineer in materials handling is one of growing importance. One spokesman for the materials handling industry puts it this way, "As manufacturing and industry become more and more complicated, I believe I can see the consulting engineer or the engineer-contractor assuming more and more importance in the materials handling picture. I think that only the very large buyer would be able to afford the engineering talent to do his own engineering. I believe that someone must serve as a coordinator, to insure proper performance of a variety of mechanical and electrical equipment interlocked into an automatic or semi-automatic system."

Looking at the situation a little more analytically, the sales manager of one midwestern firm states, "It would be virtually impossible to tie down the contribution made by consulting engineers in private practice to the materials handling field in general. In some industries, a very high percentage of the materials handling work is handled through consulting engineer organizations. I think it would be safe to say that a majority of the work done in department stores, textile plants, breweries, chemical plants, and rubber plants is handled almost exclusively by consulting engineers, or by consulting engineers cooperating with plant engineers.

"In other fields, such as general manufacturing, particularly metalworking, consulting engineers are apparently called on to a very limited degree. In both warehousing and service fields, the contacts we make with consulting engineers is spotty. Some specific industries within these fields are served well . . . others not at all.

"The over-all use of consulting engineers in the field of materials handling is definitely growing . . . and in all areas.

"As is the case in all activities involving human endeavor, we find that there are good ones and poor ones. It is primarily because we have noted that certain industries are serviced by few, if any, good consulting engineers that our company has itself entered the field of system design."

Of course, not all manufacturers are enthusiastic about the role of the consultant. One reports that, "There is a possibility that consulting engineers have in certain transactions played a part beyond our knowledge in the selection and the layout of the conveyors. However, most of our transactions involve cooperation with [employee] engineers within the company to whom the material is sold.

"It seems that we had more dealings with consulting engineers in past years than we have had in recent years. We note there is a trend among the large corporations to develop their own materials handling engineers . . ."

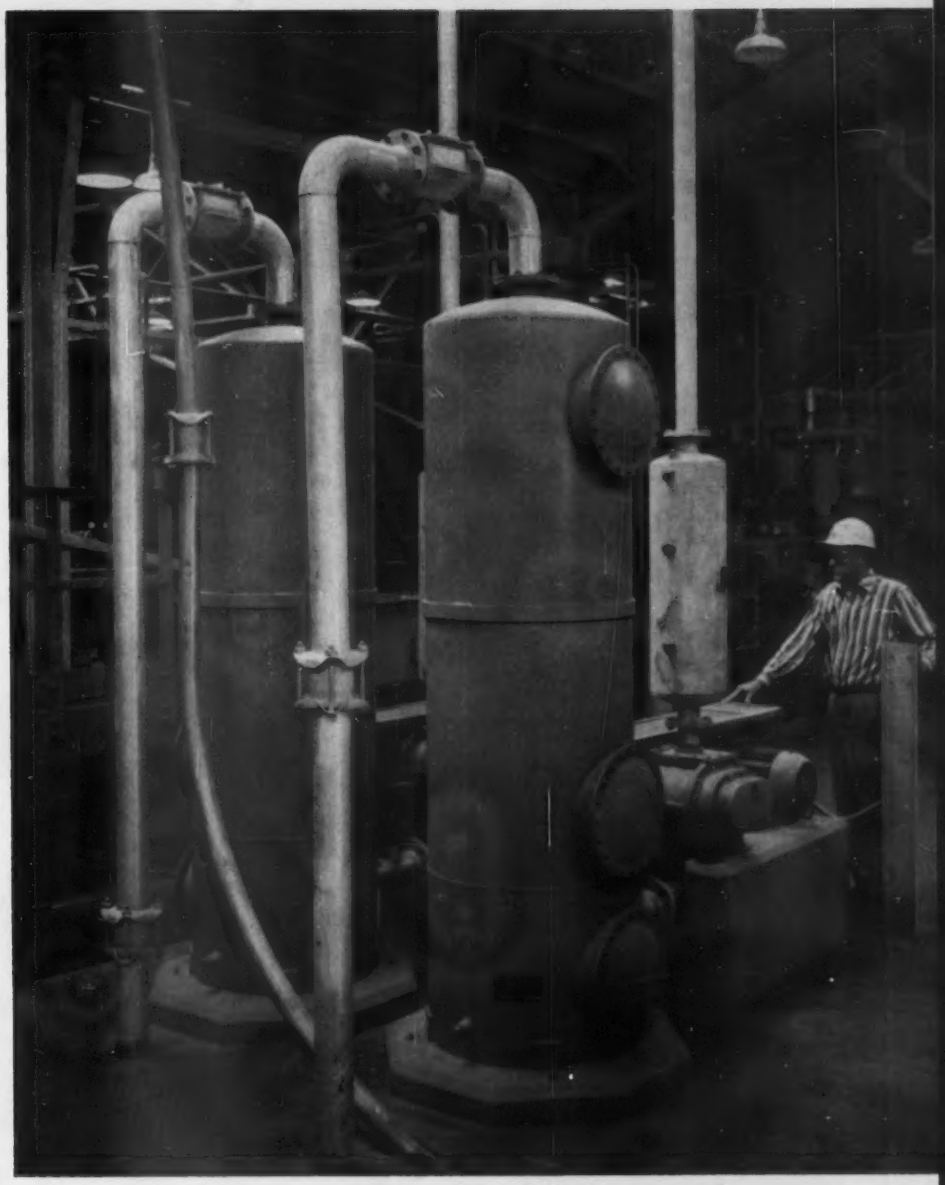
However, in spite of occasional disinterest, ignorance, and even downright hostility, it is evident that materials handling manufacturers are generally aware of the consultant and willing to cooperate with him. Still, it is equally evident that the consulting engineer is not yet playing as big a role in materials handling as he should.

Who Does the Engineering?

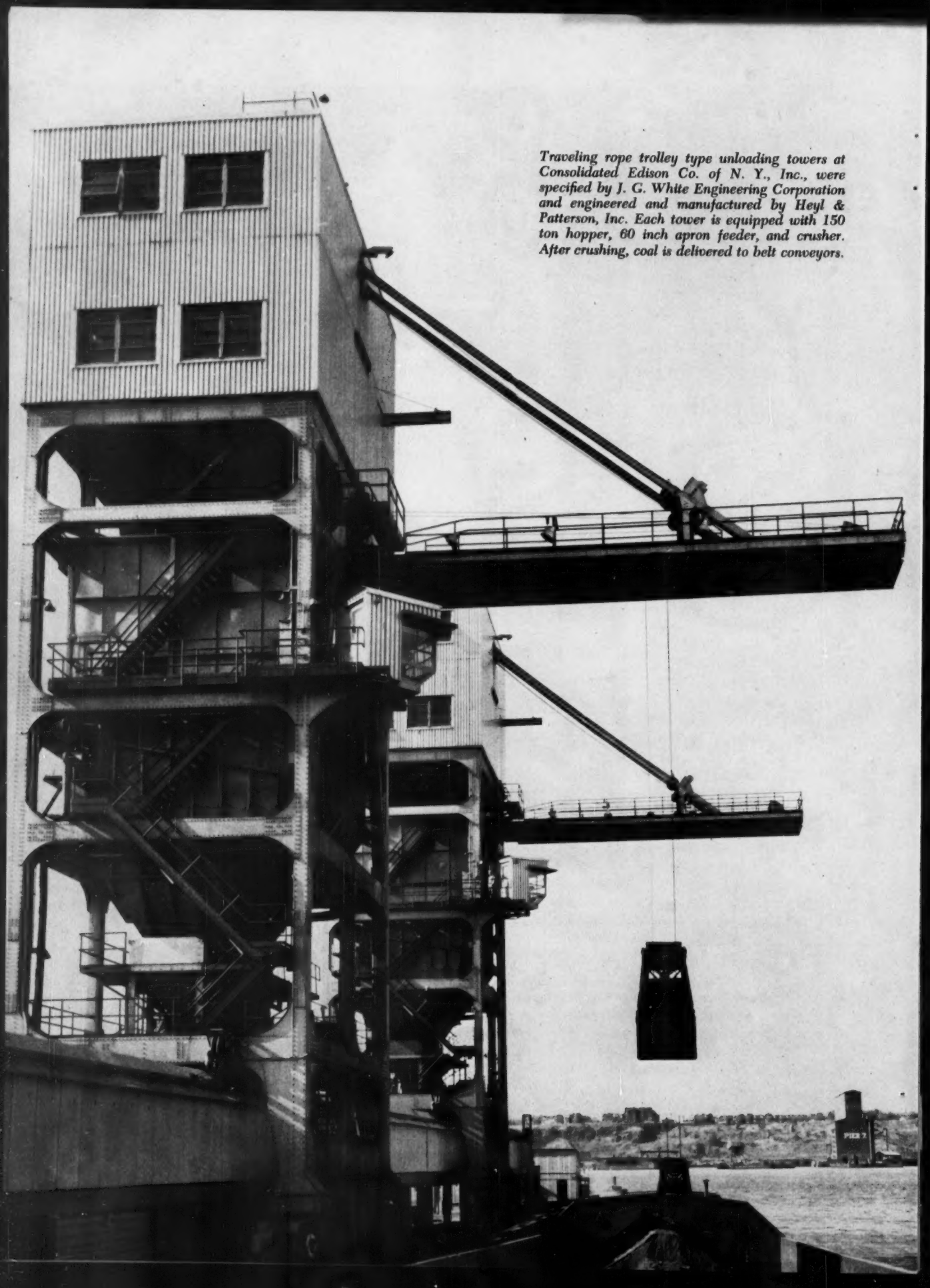
Traditionally, the manufacturer of conveyors for bulk materials has been as deeply involved in engineering as he has in manufacturing. In effect, proprietary secrets and a strong engineering department were his best selling tools. Thus, the publication of engineering data for conventional conveyors by one manufacturer, in the World War I era, had a tremendous impact on the industry. It gave competent engineers sufficient information to design their own conveyors – in direct competition with the engineering staffs of manufacturers.

Following this break with tradition, it was logical that conventional conveyor equipment, such as belt conveyor idlers, be sold on a merchandise basis. A further step was to offer a set of components which could be assembled into a complete conveyor. Thus, today, there is hardly a manufacturer of bulk materials handling equipment who does not operate two major divisions – engineering and merchandising.

This has created competition of the most chaotic kind. The manufacturer first competes with himself, then with his competitors, and, of course, with the consulting engineer. For example, it is not unusual for a consulting engineer's client to have the engineering representative of a company trying to sell him on the basis of "free engineering" while at the same time a distributor is trying to sell the same company's products on a "do-it-yourself" engineering basis. Meanwhile, the consultant himself is dealing with these same company representatives.



Air conveying has been widely used in the chemical industries. Motor, blower, and line filters in pelletized polyethylene handling system at Celanese's Houston plant are shown here. System was specified by C. F. Braun & Co. and was designed and manufactured by the Dracco Division of Fuller Company. Lines convey pelletized polyethylene to intermediate storage hoppers.



Traveling rope trolley type unloading towers at Consolidated Edison Co. of N. Y., Inc., were specified by J. G. White Engineering Corporation and engineered and manufactured by Heyl & Patterson, Inc. Each tower is equipped with 150 ton hopper, 60 inch apron feeder, and crusher. After crushing, coal is delivered to belt conveyors.

One company reports that 65 percent of its engineering division work involves consultants, and only 33 percent of its merchandising division. If this manufacturer decided to shut down his engineering operation and stick only to manufacturing, he would soon be out of business – and the consultant would be the man who put him out.

However, this situation is really not as confusing for the consultant as it would seem – provided he assumes his proper role. According to Lester L. Bosch, of Bosch & LaTour, in Cincinnati, the consultant should be concerned only with the design and specification of materials handling systems. Thus, the responsibility for the design of a specific conveyor is and should remain the province of the manufacturer. Bosch feels that the consultant seldom is forced to develop special materials handling equipment since there is a wide variety on the market, and manufacturers are willing to alter standards, when and if necessary. Just as the consultant designs pumping systems for fluids but specifies pumps, so he should design materials handling systems but specify conveyors.

The role of equipment designer can be assumed by the consultant for conventional conveyors, such as belt and screw, about which engineering information is freely exchanged, or other equipment which is nonproprietary. However, there are many conveyors protected by patent and closely held engineering discoveries which the consultant could not engineer because of infringement or lack of engineering data. Therefore, it is generally better practice for the consultant to stick to system design and conveyor specification.

It is interesting to note that the consultant plays a major role in the field of bulk materials handling, even though the industry itself competes with him. By contrast, the conveyor industry dealing primarily with packaged goods began mainly as a manufacturing and merchandising operation. Though some consultants disagree, it is commonly thought that these manufacturers only recently have begun to invade the engineering field, mainly as a result of the growing complexity of package handling systems. It is the manufacturer's claim that they must do so because there seems to be a lack of consultants in certain industrial fields which they serve.

Manufacturers of fork trucks, storage racks, overhead cranes, and similar equipment have almost always been merchandisers of manufactured products. However, here too, the problem of who engineers the materials handling system has become a sales tool. In these fields, it is generally the manufacturer's agent, rather than the manufacturer, who offers the engineering service to the potential customer. Obviously, the agent's commission must be set high enough to pay him for this service. For example, the distributor selling fork trucks frequently is expected to make complete layouts for a customer's warehousing operation, in the hope that this will enable him to sell a truck. Thus, "free engineering," often having only a casual relation to the product, is the means for making a sale.

That not all consultants have encountered these problems is evident from this statement by A. T. Gaudreau, of Gaudreau Associates. He says, "The more progressive conveyor manufacturers are usually quite receptive to the consultant's ideas of conveyor installations and gladly send their equipment engineers to work alongside him. This applies not only in remodeling old systems but also in designing new ones. In fact, the Conveyor Equipment Manufacturers Association declared unhesitatingly at its Conveyor Institute at the University of Illinois in 1953 that there was a definite place for the consulting engineer in the materials handling field. Its members have repeatedly demonstrated this friendly attitude by cooperating very closely with consultants, even to the point of developing and submitting installation bids under their guidance and as specified by them.

"Little or no difficulty is encountered by the consultant in securing cooperation from the makers of the other leading lines of materials handling equipment such as industrial trucks, cranes, monorails, elevators, highway trucks, freight cars, and cargo vessels. When building alterations are deemed necessary by the consultant to install plant-wide flow systems, the equipment suppliers are usually very helpful in rendering technical assistance concerning the use of their equipment. Like the conveyor engineers, they usually avoid all matters of building alterations and operation planning, and leave these aspects of materials handling for the consultant to handle with his client."

More consulting engineers will be likely to agree with Gilbert L. Ross of the New York firm of Ross & Company, engineers and consultants. Ross points out that, "The field of planning and designing systems for package handling is inhabited by others in addition to the professional consulting engineer. There are the manufacturers of materials handling and storage equipment and of control devices. Some of them work principally with engineers in industry and in consulting practice; some sell their equipment on a custom engineered basis. There is a good deal of traffic in so-called 'free engineering,' and 'unbiased engineering reports' (which recommend a system using the manufacturer's own products).

"However, a good part of the existing condition is due to the fact that manufacturers have not been able to find an established and reliable channel for selling their products through engineering

specifications. Too often, the engineer has relied on the manufacturer for the entire system design, in addition to the design of specific equipment.

"There is at the present time a great deal of confusion in the minds of the public and of the materials handling equipment industry as to the difference between professional engineers, who design materials handling systems as part of an integrated facility design, and management consultants who offer services in plant layout. There is need for clarification."

The Materials Handling Consultant

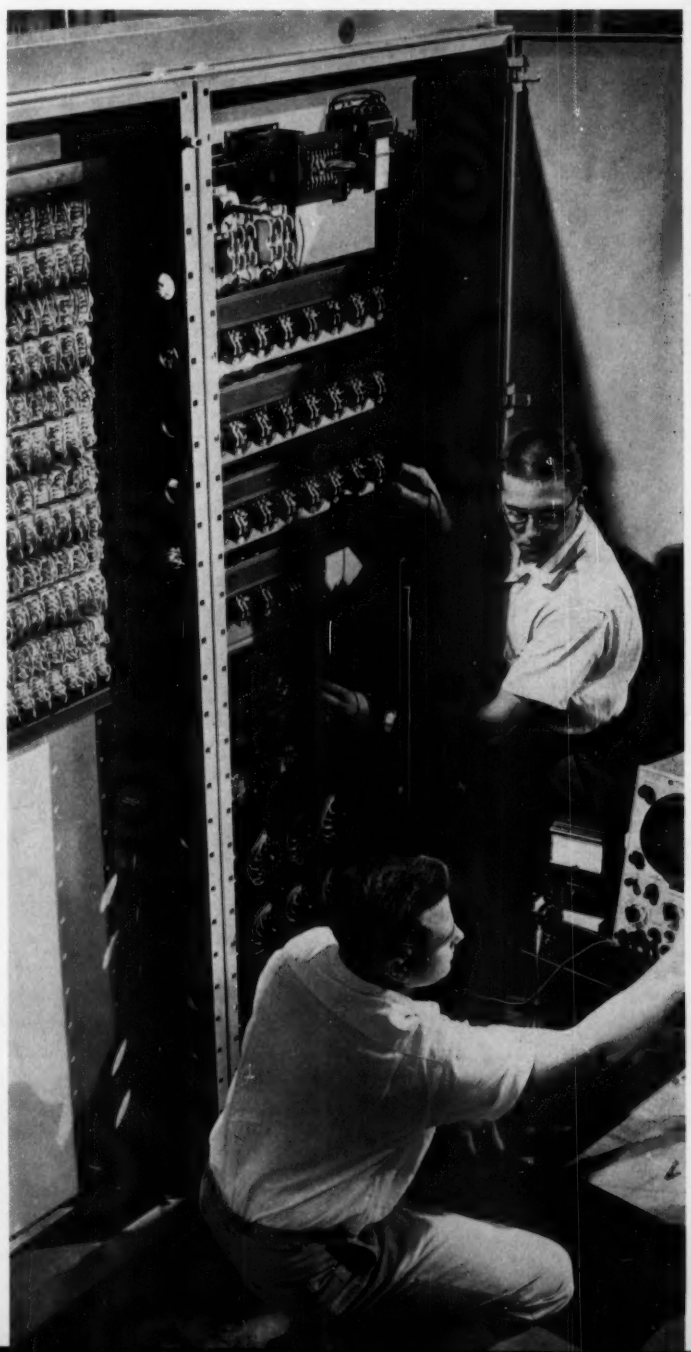
Who is the materials handling consultant? Perhaps the best answer can be obtained from the business cards of some typical firms which appeared in one of the business publications devoted to materials handling. The names range from that of a long respected consulting firm in Boston to a young California organization which bills itself as "The West's foremost professional firm specializing in complete plant layout, order, flow and warehousing systems, and elimination of excess materials handling through plant layout efficiency." In between, are a variety of management and industrial engineering consultants, most of whom are specialists in narrow fields – and often, not registered engineers.

Thus, there is obviously room for confusion among both clients and materials handling equipment manufacturers when the subject of materials handling consultants arises. And the situation is further confused by the fact that some of these "consultants" have financial interests in companies which manufacture materials handling equipment. It would appear that ethical consulting engineer firms face the distasteful task of educating both their clients and the manufacturers as to the particular role of each of these "consulting" firms – which often are assumed to be engineering firms.

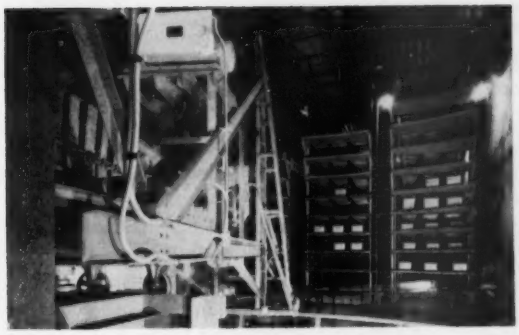
There is no question about the contributions to industry, and to materials handling, that have been made by business and industrial engineering consultants. However, when these firms step beyond their recognized fields and practice engineering when they are not registered engineers, or have a manufacturer perform engineering services in return for making an equipment sale, they are operating unethically. Unfortunately, this conduct reflects on the legitimate engineering consultant and creates serious misunderstanding as to the engineering function. Obviously, the manufacturer cannot, and will not, attempt to curb such activities. It only can be done by the consulting engineer through constant effort to provide superior service to his client. It is a difficult task, but one which has been rewarding to many successful consulting engineers with materials handling practices.

Materials Handling

The Role of



the Consultant



Bosch & LaTour was the consulting engineer on the Chelsea Milling Co. project – a highly automated carton handling system. Mechanical handling equipment then was built by the Alvey Ferguson Co. in accordance with the consultant's specifications and drawings.

When preliminary studies indicated the advantage of automatic sorting for the Chelsea Milling Company's wide variety of products, Bosch & LaTour sought to simplify the required circuitry and minimize maintenance. To virtually eliminate conventional relays, the consulting firm specified the use of static controls manufactured by Westinghouse. Specially designed pulse generator, tape punch and reader, and many other devices were engineered into the complex control system.

Materials handling has been ignored by many consultants because they could not clearly define their proper role. It is true that there is an amazing variety of materials handling equipment and an equally amazing variety of sources for "free engineering." However, in spite of these obstacles, or perhaps because of them, consulting engineers can contribute a great deal to the field.

"The preliminary engineering study," says Lester Bosch of Bosch & LaTour "is the most vital and basic factor in every major materials handling project. Here the role of the consulting engineer is unmatched. Such a study costs real money, but in the final analysis, the money thus spent by a client is the best investment he can make. It is in the preliminary study that engineering is practiced at its highest level.

"The owner," Bosch continues, "is not often equipped to make this study, and the manufacturer of materials handling equipment, even if apparently capable, cannot be expected to gamble a full measure of effort on 'free engineering' in the hope of getting an order. Only the consultant, fully ac-

quainted with the fundamental elements of the problem – and paid for his efforts – can give the client an objective study."

According to Bosch, a preliminary engineering study is essentially an economic evaluation of engineering alternatives. It is a study in which the client and the consultant should be close working partners. Imagination, ingenuity, familiarity with all varieties of equipment, and practical experience play a vital role in such a study. They are the important tools of the qualified consultant.

The consultant needs to have a good knowledge of his client's rate of return requirements for the financing of capital improvements. In addition, he needs to know of plans for increasing production or expanding plant facilities. Further, the consultant must know the true cost of materials handling in his client's plant. Too often, this is assumed to be a simple payroll figure – often only a fraction of the true cost because of other sizeable direct and indirect costs.

With this information in hand, Bosch feels the consultant can proceed with an objective analysis of engineering economics. For example, a Bosch & LaTour client was interested in installing an electric furnace line and a highly automated handling system in his foundry. All of the above factors were evaluated and the resulting data clearly showed the feasibility of the electric furnace. However, it was also apparent that the volume and diversity of the castings produced made automatic handling financially unattractive.

Having completed the engineering economic study, Bosch points out that the consultant is ready for the technical phase of the project. He is still governed by economic limitations, but his problem has now become primarily technical.

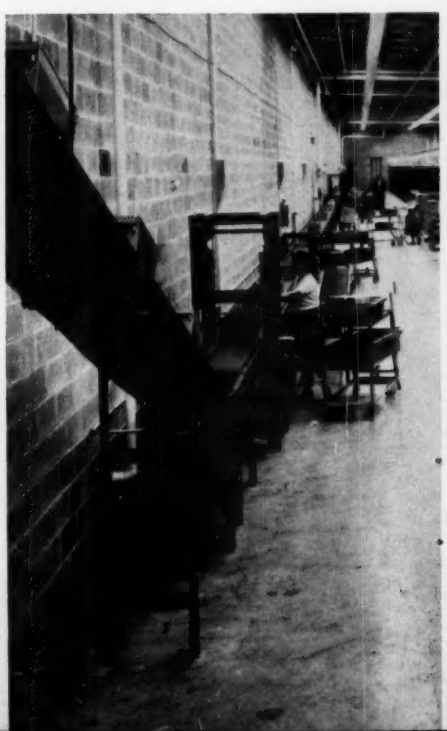
The Real Problem of Materials Handling

The real problem in materials handling, according to Bosch, is the provision of electrical and mechanical (also hydraulic and pneumatic) systems which are connected by an elastic coupling – the material to be handled. Thus, in a package handling system, the characteristics of the carton and the material it contains will determine how well the handling equipment and the control devices for it will function together. This is the area in which the consultant must assume responsibility for system performance. While the carton is on a specific conveyor or other piece of equipment, it is up to the manufacturer to guarantee that it will move in a certain manner and at a certain speed. That it will trigger the control devices properly and move through the entire system according to a predetermined program is the specific responsibility of the consultant.

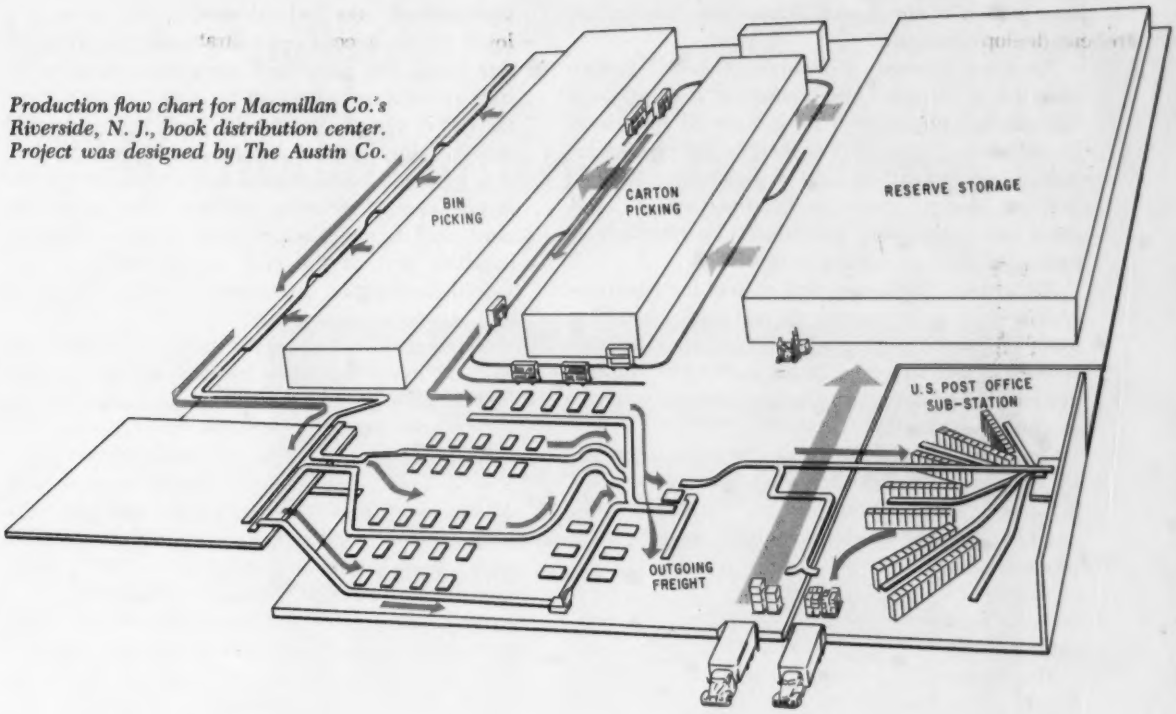
Too often, Bosch states, the consultant is reluctant to assume this over-all responsibility. If he inserts "murder clauses" in the specifications, vendors will be forced to make liberal contingency allowances in their bid figures. "Murder clauses" have no place in materials handling or any other engineering specifications.

Bosch feels that the consultant should prepare drawings and specifications which are so complete that the equipment manufacturer need not visit the client's plant. From the consultant's drawings the manufacturer should be able to get all the dimensions he needs, and the specifications should detail performance of each equipment unit so clearly that the manufacturer knows just what is expected of him. Thus, the manufacturer is fully aware of his obligations for equipment performance, while relying on the consultant for the engineering of controls which tie the components of a system together. This clear assignment of responsibility is the client's best assurance of satisfactory performance from an efficient materials handling system.

Bosch is concerned with the fact that not enough consulting engineers are active in the materials handling field. He points out that manufacturers do not willingly assume the role of project engineers, but potential clients are being lost because they cannot find competent consultants to solve their materials handling problems. The consultant will find the field demanding in terms of engineering drawings and detailed specifications, but it can be a rewarding and profitable area of activity. If the consultant will become an expert in designing materials handling systems and the manufacturer an expert in designing equipment, both will benefit – and so will the client!



Macmillan distribution center replaces six regional centers and can handle 5700 book titles totalling up to 15 million volumes. A wide variety of powered and manual equipment is used for order picking and assembly systems.



Production flow chart for Macmillan Co.'s Riverside, N. J., book distribution center. Project was designed by The Austin Co.

Materials Handling

Planning for the New Plant

The materials handling approach of The Austin Company, which is engaged primarily in new plant design and construction, has been spelled out by S. G. Richardson. He points out that the ultimate objective of all materials handling should be improved service and lower over-all operating costs. Viewed as an integral part of the total operation, materials handling starts with the selection of the plant location and takes into consideration such factors as sources of raw materials, availability of transportation, availability of labor, and the consumer market to be served by the plant.

This requires long range evaluation of how a particular plant fits into the total system of plants serving the market, with due allowance for growth factors and the effects of competition.

Even the orientation of the plant on the site may have a profound effect upon materials handling costs. This becomes apparent in due course if fu-

ture growth is not provided for when initial plans are being developed.

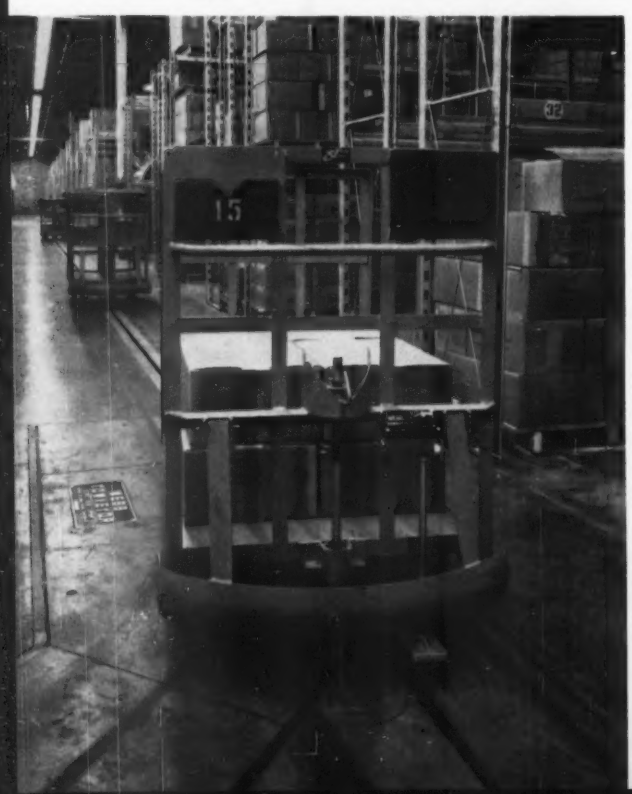
As plans proceed, a number of broad factors must be given due consideration at each stage if the ultimate objective of lower over-all costs is to be achieved. These matters include the process involved, equipment layouts, departmental layouts, building design, materials handling system, and often the paper work procedures (particularly if automatic data processing is involved).

Richardson emphasizes that among the commonly recognized influences on materials handling methods are the manner of arranging shipping and receiving facilities, the juxtaposition of various productive and nonproductive departments, and the machines within these departments.

One point frequently overlooked is the desirability of providing for internal as well as external expansion. Management may not be able to add more building immediately when the need for more production space occurs. Space for internal expansion usually can be provided in advance, however, by placing nonproductive departments, without major fixed equipment, near production areas.

The design of the building itself influences each stage in the development of a plant layout and the selection of the materials handling system. One common misconception of how to lay out a plant is to "arrange the machines and the departments for an efficient flow, reduce the materials handling to a minimum, and wrap a building around it."

Tow conveyor automatically sidetracks trucks at switch points where additional books are needed.



This method, says Richardson, does not necessarily result in the lowest operating costs. To illustrate this point, it is sometimes more economical to install an overhead conveyor to carry products from the end of the production line back to a somewhat remote shipping dock near the receiving dock, than it is to install another door and a road on the site to take care of outgoing products. The cost of the road, and its maintenance, is as much a materials handling cost as the cost of the conveyor, and should be weighed accordingly to establish lowest total operating costs.

Accomplishing the goal of better customer service and lower operating costs requires the integration of many factors and talents, according to Richardson. The client and his operating and administrative staffs, various industrial location agencies, transportation agencies, local, regional, and national governmental agencies, the designers, the engineers, the builders, the equipment manufacturers, and the client's suppliers — all of these groups may make substantial contributions.

Richardson states that since The Austin Company offers a complete location, design, engineering, and construction service, including the design and construction of complete automatic data processing systems by its electronics division, it can mesh its efforts with any planning or construction that the client may wish to do himself.

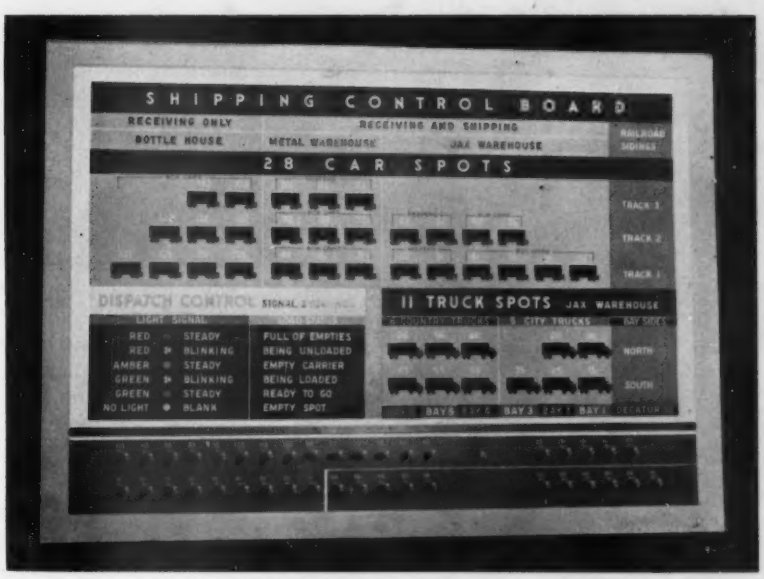
Usually, Austin engineers recommend that the client establish a small committee, consisting of the man who is going to be in charge of the new facility, one or more representatives from engineering, production, maintenance, and accounting (other departments as required), and the designer's project engineer. This committee, usually of less than six people, with the owner's representative as chairman, is directly responsible to top management for all phases of the project.

Normally, the first job is to establish the basic concept of the materials handling system, in cooperation with the client. Then the equipment manufacturers are consulted on how this concept can be effected, before detailed engineering drawings and specifications are prepared.

Naturally every effort is made to use standard equipment, but standard equipment is not always the most satisfactory from the client's standpoint. For example, a special fork lift truck was determined to be most suitable for a particular operation in the new shipping center for the Timken Roller Bearing Company, at Bucyrus, Ohio. The preliminary design for the truck was developed jointly by the client and the engineers. Then the design was taken to a manufacturer for refinement and detailed engineering prior to actual construction of the truck.

Materials Handling

Remodeling the Old Plant



Remodeled materials handling system at a southern brewery was handled by Gaudreau Associates. Push-button control board is designed to control loading of 39 carriers spotted at car and truck docks strung out on two sides of building along two city blocks.

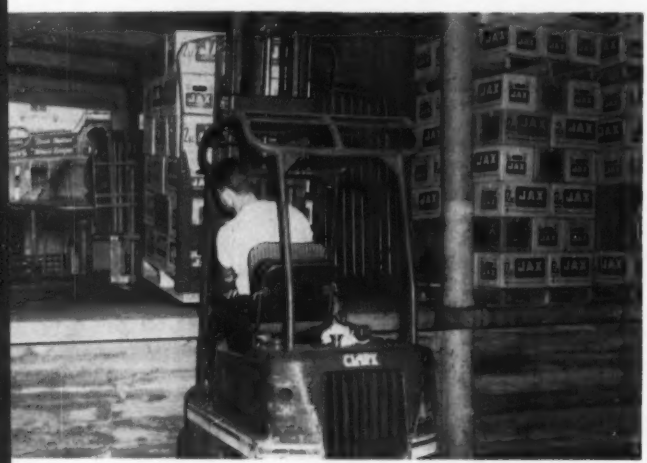
A. T. Gaudreau, of Gaudreau Associates, has had many projects involving a remodeling or modernization of old materials handling systems. He is well qualified to comment on the peculiar problems they create. Gaudreau has discovered that where materials handling begins and ends in a plant, warehouse, or freight terminal varies with each individual, depending upon his point of view and scope of activities. To the machine operator in a factory, materials handling consists mainly of the movement of materials at his work station. From his point of view all of his materials handling problems might well be solved by the use of a jib hoist or crane hook. He therefore tends to lean towards the claims of the crane suppliers.

The departmental operation supervisor, on the other hand, does not confine his thinking to one work station at a time. Materials handling to him usually means the movement of materials through transportation, storage, and shipping operations. In this conception, work stations are but feeders to the flow of materials through his department.

Materials handling at the work station now becomes work positioning, and the movement of materials through his department conjures up thoughts of traveling cranes, conveyors, and industrial trucks. Consequently, he is receptive to the sales representations of all three of these lines of materials handling equipment. Seldom, however, can he pass judgment on their relative merits.

Under these circumstances, Gaudreau points out, he may be inclined to view materials handling as being best served by a given type of equipment, such as high-platform floor trucks. The supervisor in the department next to him may select powered fork trucks to handle the same material as it reaches his work area. And the next department along the line may have installed conveyors to carry on the flow of work. In fact, it is not uncommon to find a different line of materials handling equipment in several departments of a plant or warehouse. Many handling problems are thereby self-inflicted by the unnecessary transfers of materials from one type of equipment to another.

Palletizers on ground level discharge to conveyors which carry pallets to elevators lifting to the dock.



Fork trucks may also pick up pallets at palletizer level and carry them to storage or truck loading dock.

Materials handling routine in the various departments of a plant or warehouse usually does not pose a problem until the factors of operating cost, speed, and capacity are duly considered. Force of habit and the human tendency towards conformity to existing handling shortcomings have a way of ironing out wrinkles in operations. In walking through a plant for the first time, all movements of materials appear to be in smooth working order. Heavy loads are being moved without strain, and tiresome efforts are not in evidence. There is no obvious display of faulty materials handling.

However, says Gaudreau, a look at the operating costs being incurred in this placid atmosphere may reveal the existence of a considerable amount of excessive handling not justifiable by the production or storage volume of operations. By allowing materials handling operations to follow the course of least resistance in the separate operating departments, a disintegrated material flow has gradually been developed through the plant. In each department the attention usually has been focused on the merits of a particular type of handling equipment. Since such equipment may not have been found suitable for handling the same material in an adjoining department, another specialized type was introduced in the latter. Thus, a motley assortment of noninterchangeable handling devices has created a costly, inefficient, and disjointed flow of handling activities in what are otherwise modern establishments.

The best handling system for a plant or warehouse is the one that provides the easiest course to follow from department to department, floor to floor, and building to building. Such a system should provide a standard line of materials handling devices, such as monorails, conveyors, industrial trucks, and trailer trains, which are interchangeable between departments. It should, above all, incur the lowest operating costs compatible with efficiency of operations and handling capacity.

Gaudreau says that the system meeting these requirements often requires building alterations and operation planning which usually are not developed by equipment sales engineers. The conveyor representative is, by virtue of his business connection, primarily interested in selling conveyors. The same one-way leaning is true also for the salesmen of other types of equipment. They are out to sell their particular line of devices, and their minds are concentrated on applying these devices to whatever handling problems they encounter on a prospective customer's premises. In fact, some of them may go so far as to appropriate the customer's most valuable operating space by positioning their equipment in the very center of the area regardless of the aisle space wasted on both sides of the unit.

Through lack of proper planning, the overhead space needed for high-stacking in many establishments frequently is lost by being appropriated for additional conveyor runs laced more or less indiscriminately through these overhead areas. Also, conveyor runs sometimes gradually develop into sprawling work-height networks penetrating floor stock from all angles, converting storage areas into checkerboard squares. Eventually conveyors may occupy more floor space than the stock itself.

Usually, before this occurs, management calls in outside consultants to survey the entire handling system. Not infrequently such abusive installations are thrown out entirely and replaced by a more efficient line of equipment for handling the materials formerly moving helter-skelter on a piece-by-piece basis through a maze of intertwined conveyor runs.

Kansas City Power & Light Co.'s new Montrose Steam Station was designed by Ebasco Services, Inc.

Materials Handling

Special Problems

Montrose Station coal handling equipment was designed and manufactured by Stephens-Adamson Mfg. Co. in accordance with specifications prepared by Ebasco.

Many consulting firms must deal with the highly specialized problems encountered on materials handling systems for steam stations, cement plants, sand and gravel plants, and similar operations. Ebasco Services, Inc., is well known for its design of central steam power stations. C. T. Smith, Ebasco mechanical engineer, points out some of the special considerations that go into the design of coal handling systems for central steam stations.

Fuel-handling installations for Ebasco clients during recent years have had to serve three general types of delivery situations:

¶ Conventional rail delivery, where fuel arrives at the plant in standard railroad hopper cars, and where, generally, a backlog of loaded cars can be made available.

¶ Barge delivery, on inland waterways or harbors. Here, arrival of shipments may sometimes be er-

ratic, due to waterway or weather conditions. Further, particularly with river barges, the unloading rate may not be constant.

¶ Mine mouth plants, where the most economic rate for mining and delivery may not, and probably will not, coincide with the most economic rate for putting fuel into the plant bunkers.

Smith has found that where the fuel is delivered in conventional hopper cars, plans usually must include a car shaker over a combination unloading and reclaiming hopper. From this hopper fuel is conveyed to a crusher house, where crushing equipment is provided to size the fuel to ¾" or 1¼" for pulverizers; or down to ¼" for cyclone furnaces. From the crusher house, fuel is conveyed to the station, where it is distributed to the bunkers or silos by tripper or shuttle conveyors. At the crusher house, provision usually is made to divert fuel to a permanent reserve storage pile, sized to take care of plant needs for 60 to 90 days.

For a one- or two-unit station, a single belt system normally is used, figuring on one shift operation for the first unit, and two shifts for two units. Provision frequently is made, by way of allocation of space, for a duplicate conveyor and crusher installation to serve a third and fourth unit. A single car shaker and hopper will care for, conservatively, six cars per hour. Where there are possibilities that future unit additions may require use of a car dumper, or a second car shaker, space is allocated, and appropriate "knock out" holes are left in concrete pits and tunnels. Unless additions are programmed for the very near future, plans for expansion are made at the lowest possible initial cost.

Ebasco has found that at plants on the inland waterways, when fuel is delivered in river barges, design must be governed by the possibility of more erratic delivery schedules than is the case with rail delivery. Equipment will include a clam shell unloading tower at the river bank, with a dock and facilities for handling the barges under the tower. A river man's rule-of-thumb for unloading barges states that two-thirds of the material in a barge will be removed in one-third of the total unloading time, when "free-dig" capacity will be realized. "Free-dig" capacity may be defined as that capacity resulting when there is sufficient depth and volume of fuel in the barge so that the clam can be fully loaded with a single operation of the closing mechanism, with no maneuvering of the bucket. "Clean-up" capacity may well be one-third to one-half that under "free dig" conditions.

It has been Ebasco's practice to design the unloading part of the conveyor system to handle the "free-dig" capacity of the unloading tower. This part of the conveyor system will include the feeder under the tower hopper, the main conveyor from the tower to the plant area, and a stacker conveyor discharging to a "surge" or "ready" pile. This pile may be located above reclaim hoppers, to which much of the fuel may flow by gravity. From the reclaim hoppers, fuel is conveyed, crushed, and distributed to the station bunkers in conventional fashion, as outlined for the rail delivery plant.

Smith points out that provisions for ready piles usually are included in conveyor systems for mine mouth plants. The term "mine mouth" refers to any station where fuel is delivered from the mine directly to the plant, whether by coal haulers over a private road, by special rail cars over a private railroad, or by overland conveyor or tramway. As stated previously, the economic mining rate and the economic rate for taking coal into the plant may not be alike. In a comparatively recent instance, plant requirements were to be 2000 tons per day, six days per week. The mining company involved wished to mine and deliver coal at a rate of 3500 tons per day, the mining rate being determined by the capacity of available shovels and other mining equipment. It was recognized, of course, that the mining rate and plant demand had to dovetail. In this case, the mining company was perfectly willing to work a three- or four-day week.

In cases of this kind, says Smith, if the delivery rate must equal the mining rate, that part of the fuel-handling system receiving fuel from the transportation system must also be geared to that same rate. Again, the system from the reclaim hoppers, through the crushers, to the station bunkers, can be designed to suit plant-fuel requirements.

Whenever a "surge" or "ready" pile is used, with reclaim hoppers beneath it, Ebasco prefers to include an additional hopper, located beyond the area of the pile. This "open" hopper serves two purposes; it provides insurance in the event that a plug should occur in the underpile hopper, offering a place to dispose of coal from the pile should it be necessary to uncover the pile hopper to get at the plug. It also provides a way to reclaim fuel from the permanent storage pile, should this be desirable, either for blending or in the event of an incipient fire in the permanent pile.

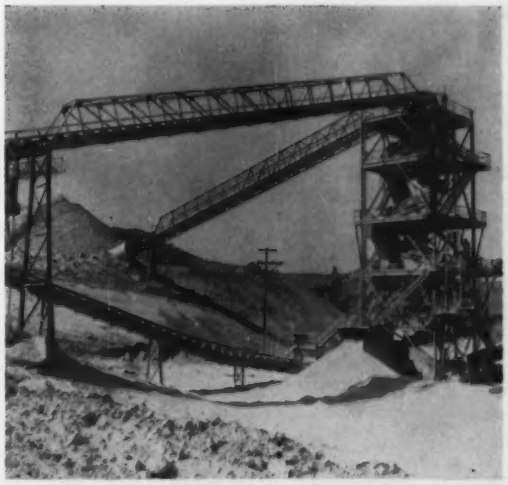
Recent Ebasco installations have employed open gallery construction, with a simple hood over the carrying run of the conveyor. The one exception to this practice occurs when large lump coal is to be handled, from a receiving hopper to a primary breaker. Here a full gallery housing is used in lieu of a hood, to avoid any possibility of the large lumps jamming up under the hood. In some instances, crusher and breaker houses have been roofed, but otherwise left open, although the steel supporting structure usually is designed to permit the future addition of siding.

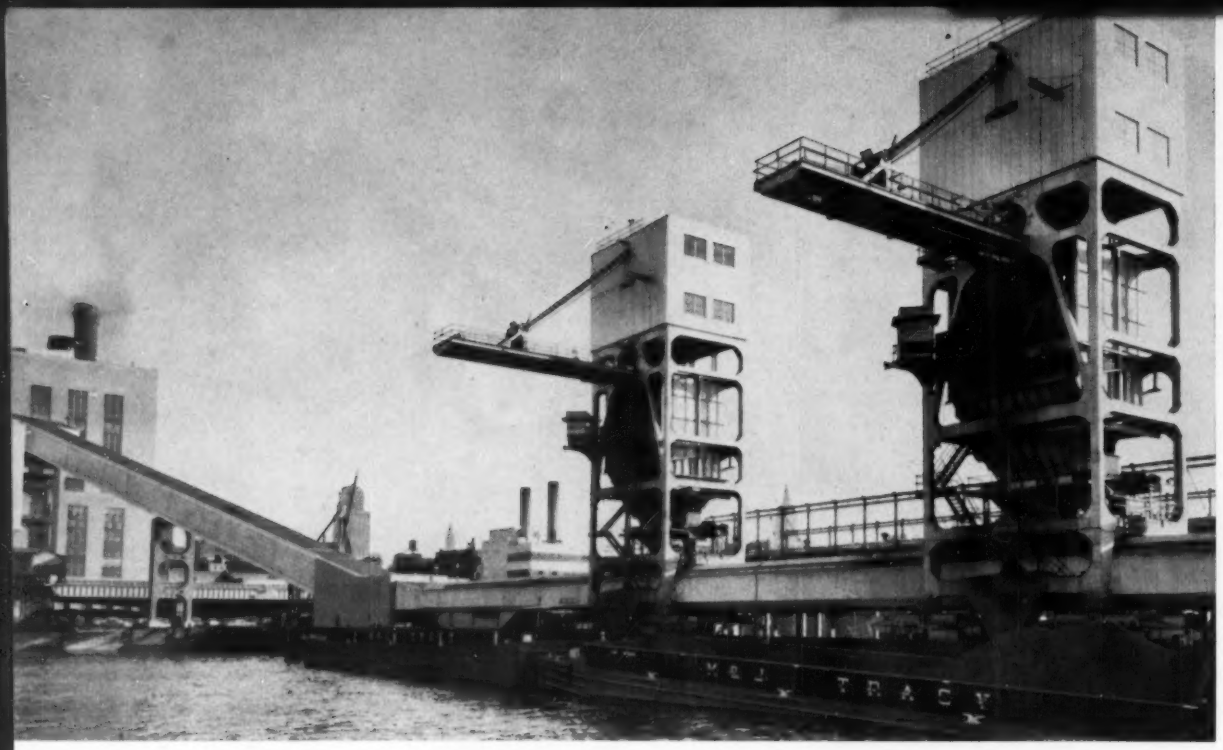
Materials Handling

Aggregate, Sand, and Gravel

Arther E. Howland Co., Los Angeles consulting firm has specialized in the design of sand and gravel and crushed stone plants and similar installations handling large tonnages of bulk materials. Above is the El Rio, California, plant of Southern Pacific Milling Co. which was designed by Howland engineers to handle 600-tph to the surge pile. By maintaining ample headroom throughout the plant, the designers were able to provide for changes in flow circuits through the simple expedient of adding chutes. Maintenance was reduced by placing riffles in chutes and arranging for material deposit shelves in transfer boxes, screen head boxes, and similar locations to prevent excessive wear from the abrasive material.

Views at right show the Missile City Rock Co. plant at Lompoc, California. The plant was designed to supply large tonnages of aggregate to Edwards Air Force Base. Supporting structures at this plant were designed with bolted construction to provide for easy dismantling and relocation if it should be required in the future. Howland engineers provided complete drawings and specifications covering structural, mechanical, and electrical details.



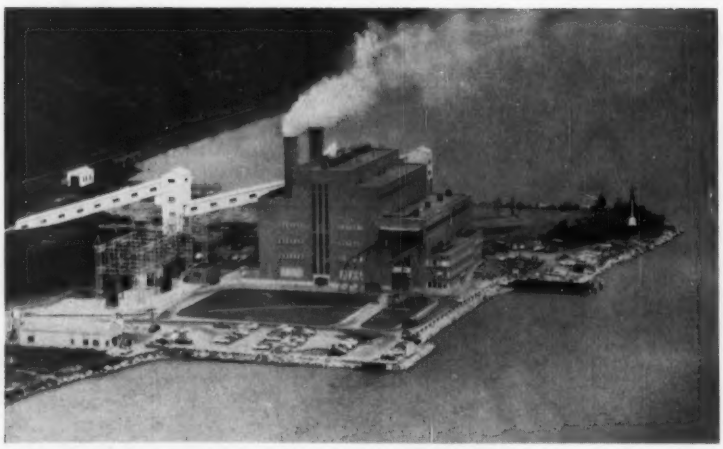


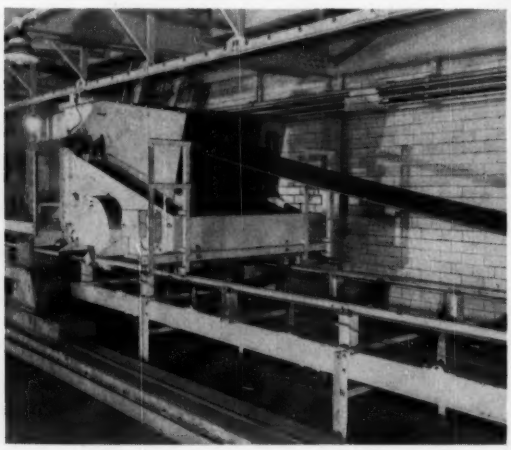
Twin unloading towers are typical for steam stations depending on river borne coal. The traveling units shown above, equipped with feeders and crushers, can handle 504 net tons of coal per hour. J. G. White Engineering specified these two Heyl & Patterson units for the Consolidated Edison Co.

Materials Handling

Coal

Burns & Roe, Inc. was the consultant on the Danskammer Point Steam Station of the Central Hudson Gas and Electric Corp. Coal handling equipment was designed, fabricated, and erected by the Chain Belt Company. It can handle 300-tph from 50- or 60-ton capacity hopper cars, via 13-ft square steel track hopper feeding the conveyors.

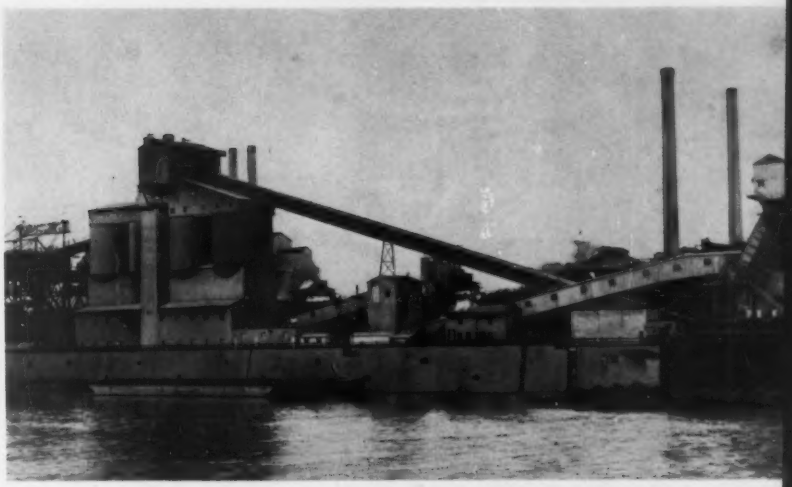




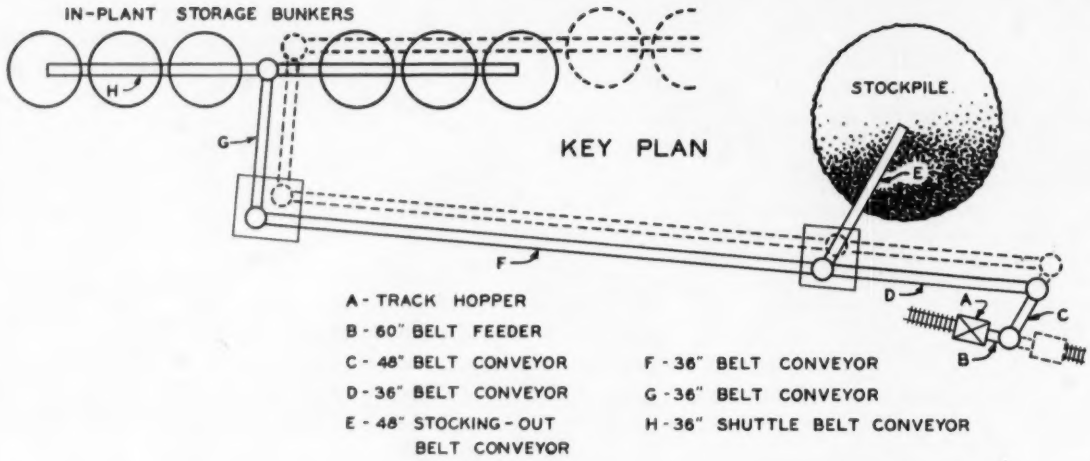
Roberts & Schaefer Company were the engineers on this huge coke and coal chemical plant which can handle 2000 tons of coal an hour. Contract for design, fabrication, and erection of bucket unloader for barges was awarded to the Link-Belt Company. The three bucket lines of the unloader cover a width of 18-ft and can empty a 900-ton river barge in less than ½ hour. Coal is also received by rail.

To coordinate the various processing and transportation phases of this huge plant into an over-all flexible operations schedule required extensive pre-engineering study. Scale layouts were the basis for the final design.

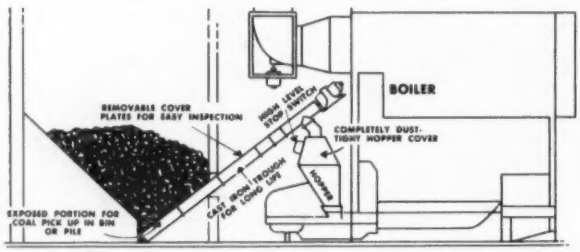
The electrical system for this plant begins with two transformer stations connecting 6900 volt, 3 phase, 25 cycle current to the primary switchgear. Included are interlocking performance relay controls for ac and dc motors totalling about 3820 hp.



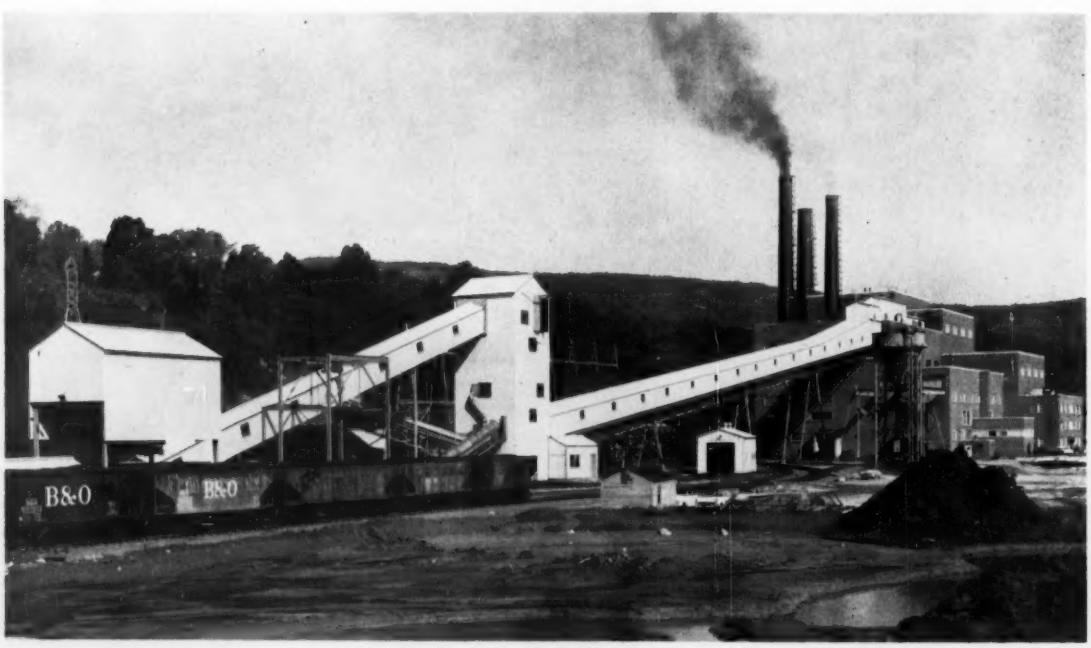
This unique structure was designea by James N. DeSerio, consultant for the Rochester and Pittsburgh Coal Company. Run-of-mine coal is loaded into the 50-ton hopper, with the coal dropping into separating and sizing screens which simultaneously deliver three different sizes via conveyors and chutes. The structure can be moved about the company's yard on skids.



Key plan for United Illuminating Company's Bridgeport Harbor Station in Connecticut. Jackson & Moreland, Inc. was the consultant. Cool handling equipment was designed and monufactured by Stephens-Adamson Mfg. Co.


BOILER
REMOVABLE COVER PLATES FOR EASY INSPECTION
HIGH LEVEL STOP SWITCH
COMPLETELY DUST-TIGHT HOPPER COVER
HOPPER
CAST IRON TROUGH FOR LONG LIFE
EXPOSED PORTION FOR COAL PICK UP IN BIN OR PILE

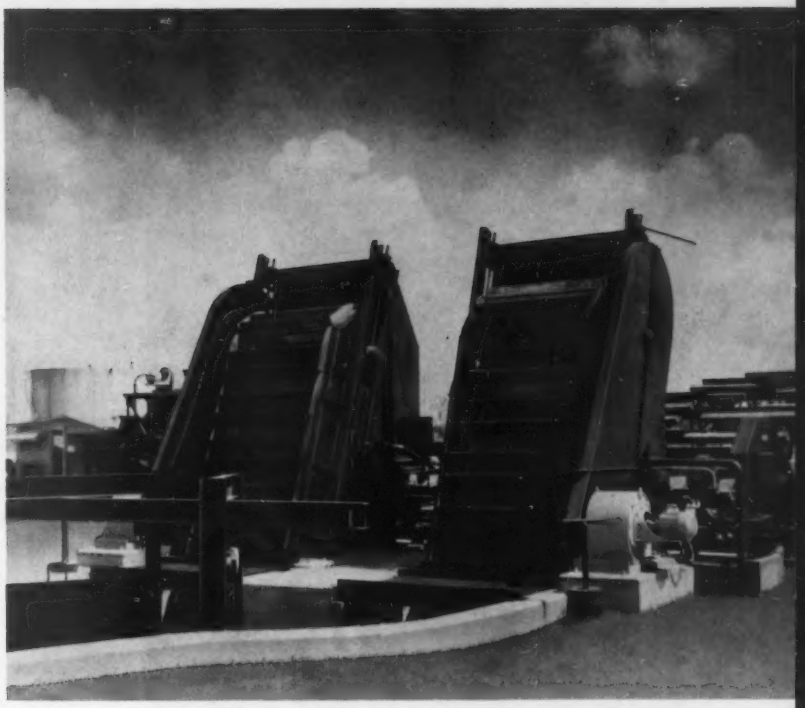
Consulting engineers frequently find that they can specify "package" conveyors such as those provided by the Canton Stoker Co. Units come with direct coupled drive and pre-wired panel board with safety disconnect switch and magnetic starter. Bin level controls can be installed to make the system operate without employee supervision.



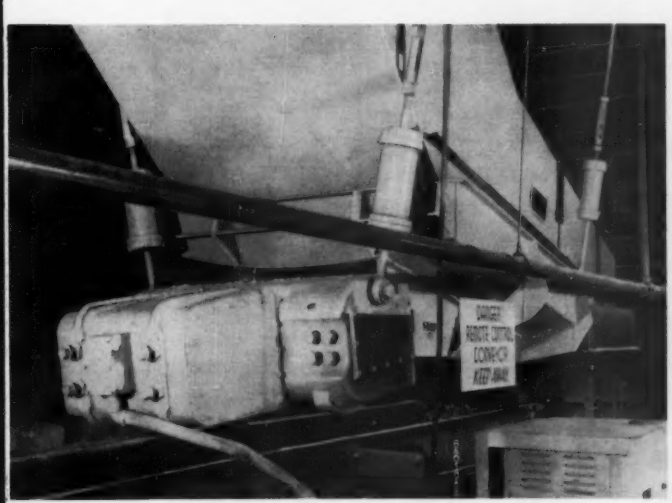
Rockland Light and Power Co.'s original Tompkins Cove plant was designed by Burns & Roe in 1948, with conveying equipment by Stephens-Adamson Mfg. Co. Provision for expansion made at that time has since been utilized, with coal handling boosted from 125- to 450-tph. New conveyor at crusher house increased yard storage.

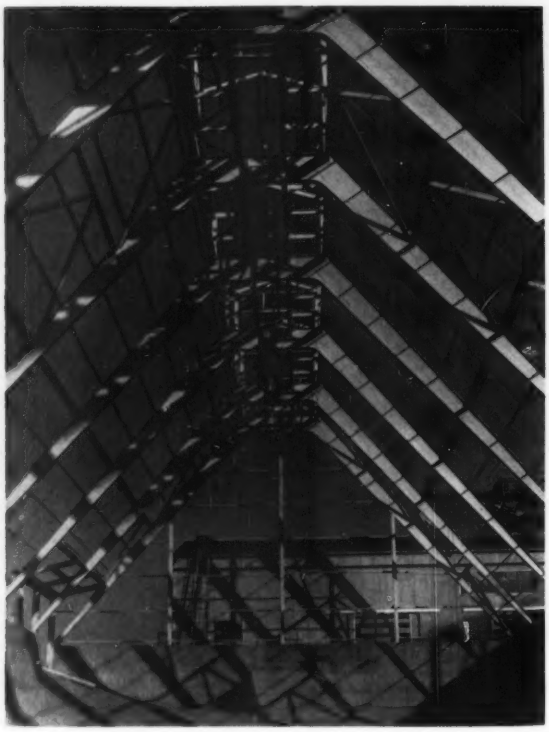
Materials Handling

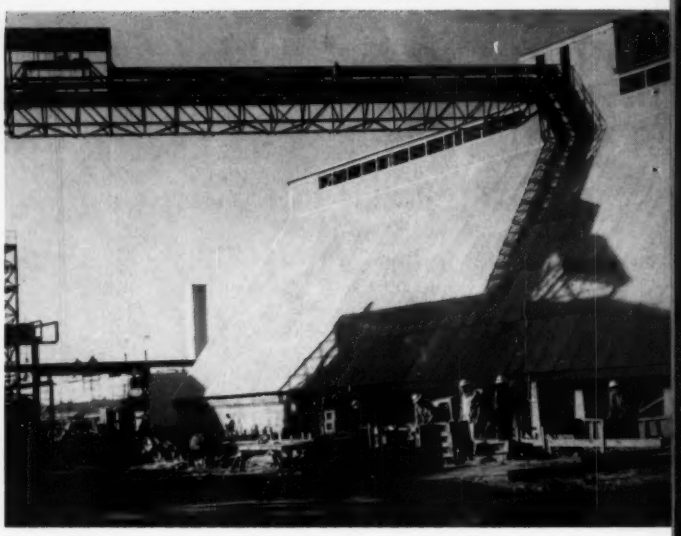
Wood Chips



Rayonier called on Ebasco Services Inc. for engineering services in the expansion program for their Jessup cellulose mill. Wood chips are converted to produce 300-tons of chemical cellulose per day, doubling the capacity of the orginal 1954 plant. Belt conveyors, vibrating conveyors, water screens, and other materials handling equipment were provided by the Jeffrey Manufacturing Company in accordance with Ebasco specifications. Electric vibrating feeders are remote controlled to deliver specific rate of flow to continuous processing operation. Traveling water screens are designed to remove bark and grit preliminary to the clarification of the process water.



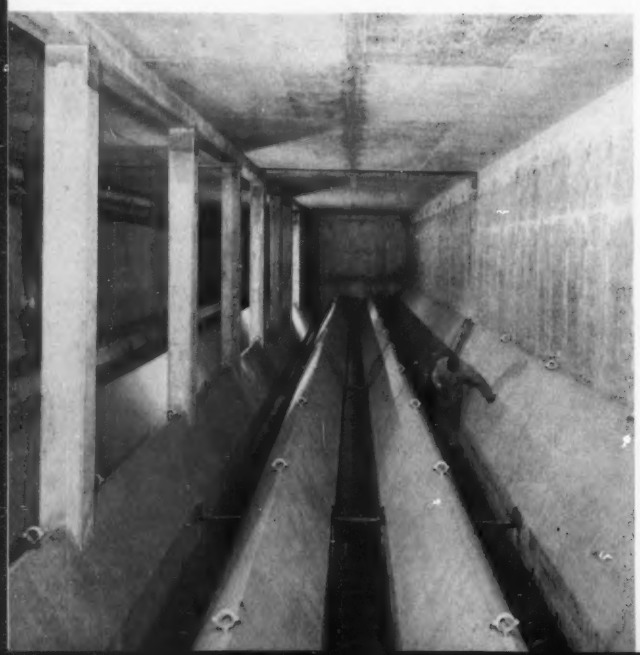




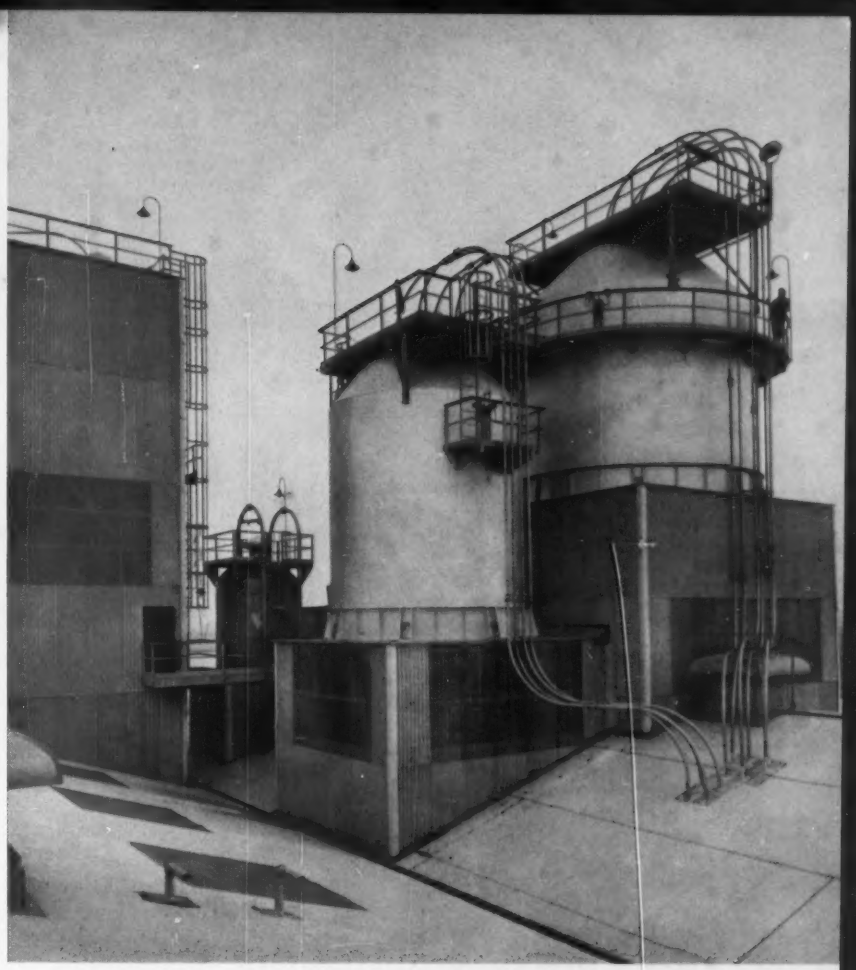
Thomas & Hopkins designed this storage and reclaiming system for ammonia sulphate. It replaced a traditional silo system proposed by a contractor and materials handling vendor, and affected a saving of about 30 percent on the original investment. More important, it solved a difficult reclaiming problem.

Materials Handling

Other Bulk Materials

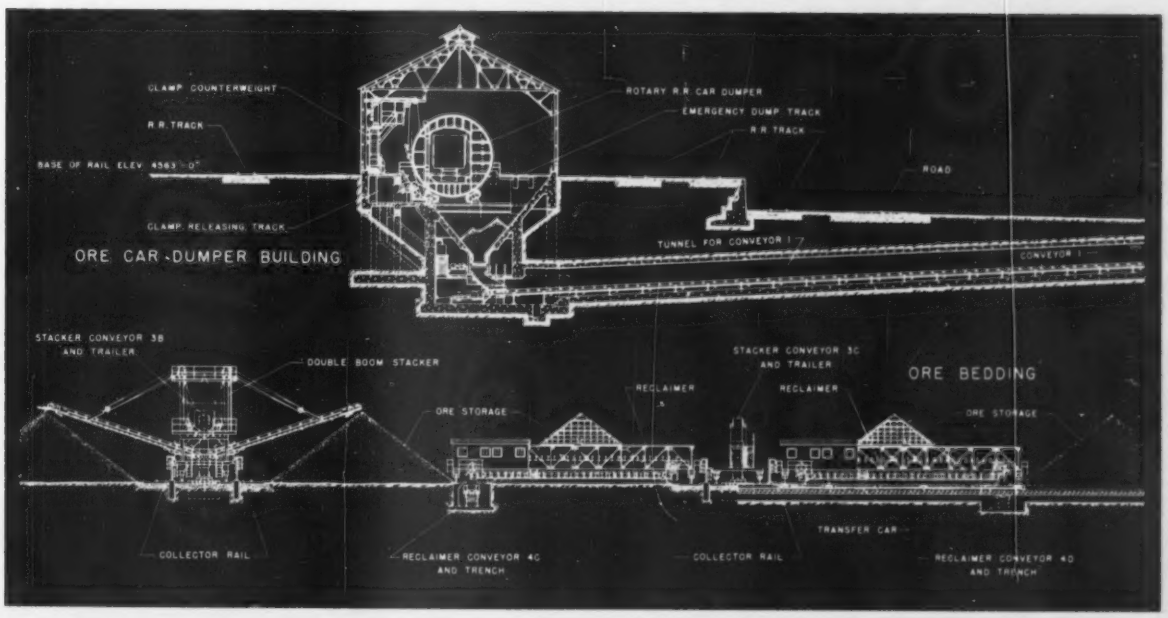


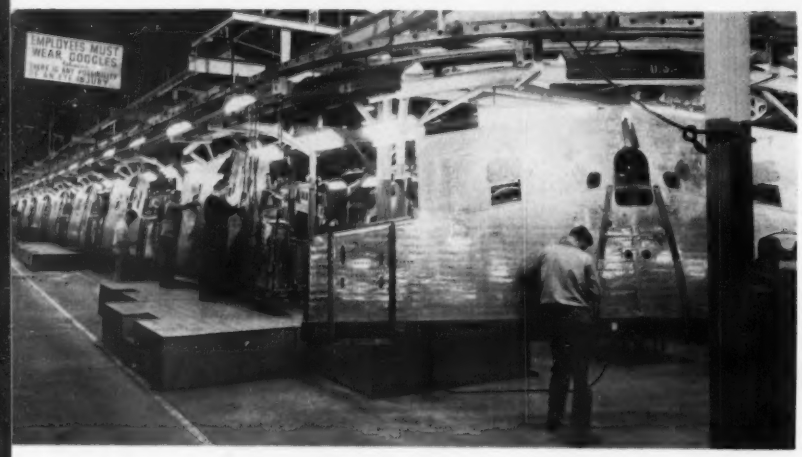
Consulting engineer on the new Pittsburgh sewage disposal system was Metcalf & Eddy. Materials handling equipment, which plays an important role in such systems, was furnished by the Link-Belt Company. Shown here is one of nine heated raw sludge tanks with short pitch screw conveyors designed to homogenize and remove the concentrated sludge after the subnatant has been withdrawn. System is being checked before startup.



Air conveyor lines rise to top of outside storage tanks at the Houston polyethylene plant of the Celanese Corporation of America. Intermediate storage system holds pelletized material above blenders. The complete plant was designed and erected by C. F. Braun & Co., with the air conveyor equipment designed and fabricated by Dracco Division of the Fuller Co. Rated production of the plant is 40 million pounds per year.

A. J. Boynton & Co. designed this ore handling and preparation system for a large steel plant on the West Coast. Car dumpers feed ore to a system of belt conveyors running to the double wing stackers which deposit a uniform layer of ore on the long piles. Reclaiming is accomplished by a frame studded with harrow points which draws ore from the full cross section of the pile. Ore is then screened, with coarse ore going to furnaces. The fines are sintered.

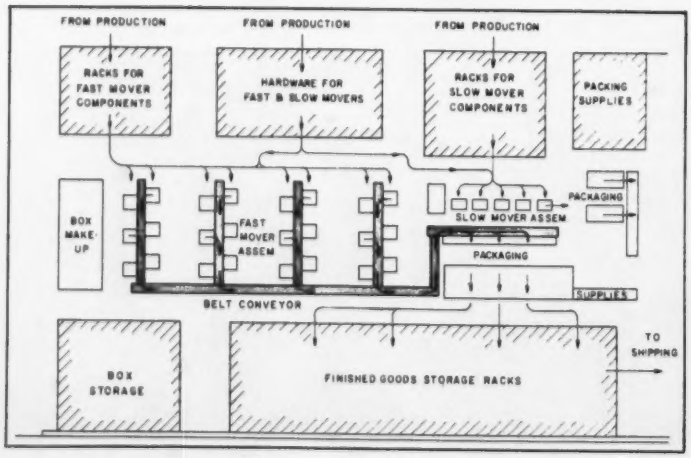


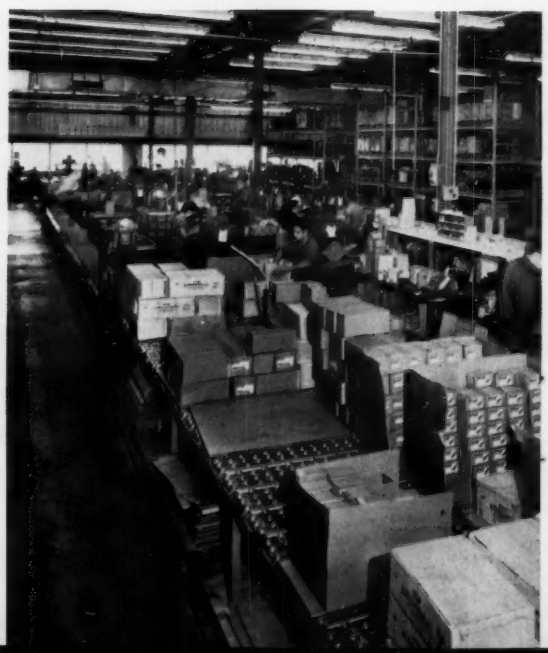


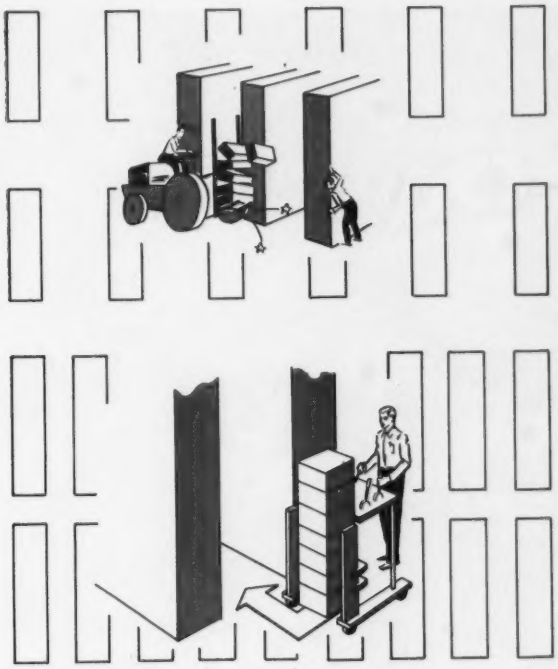
Materials Handling

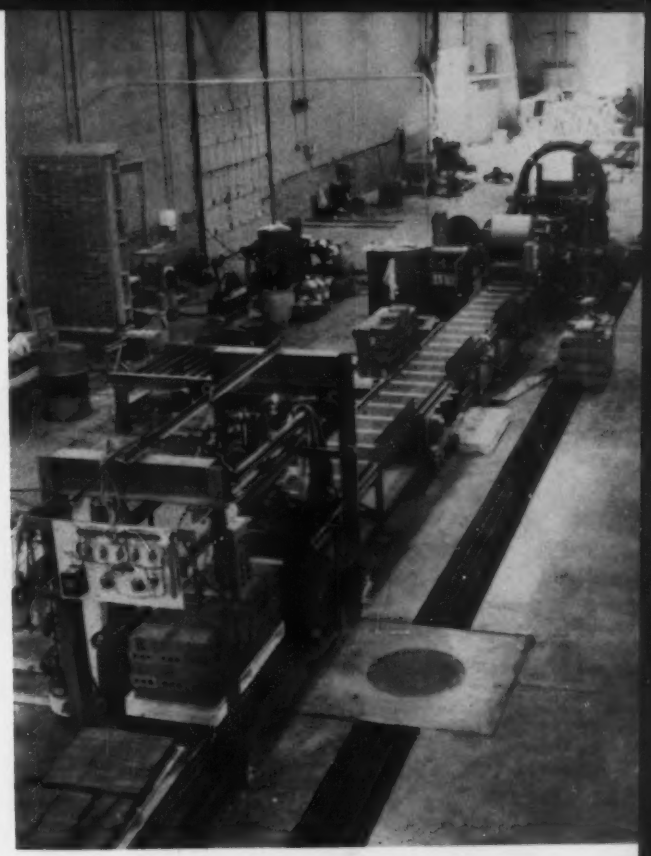
Unit Loads

Running a flat belt conveyor over a street poses no serious technical problems. However, it took the consulting firm of Thomas & Hopkins nine months of negotiations before city officials were convinced that by replacing heavy trucks with a conveyor system the city would actually save money in street repairs. It was under an entirely different atmosphere that Thomas & Hopkins designed an overhead assembly system for a West Coast aircraft plant. Essentially a closed loop approximately 400 ft from end to end, the system operates at three different levels, has three interlocked jig stations and a rework switch-out. It replaces an assembly and jig system that required three large buildings, reduced personnel by 60 percent, and increased the daily production.

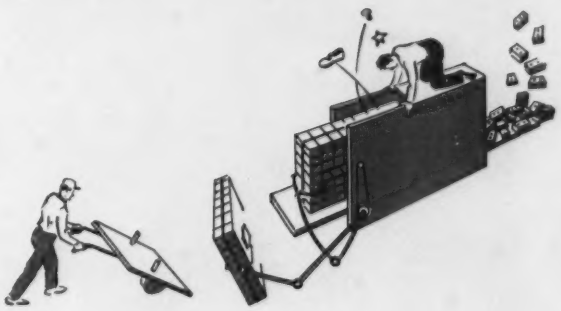








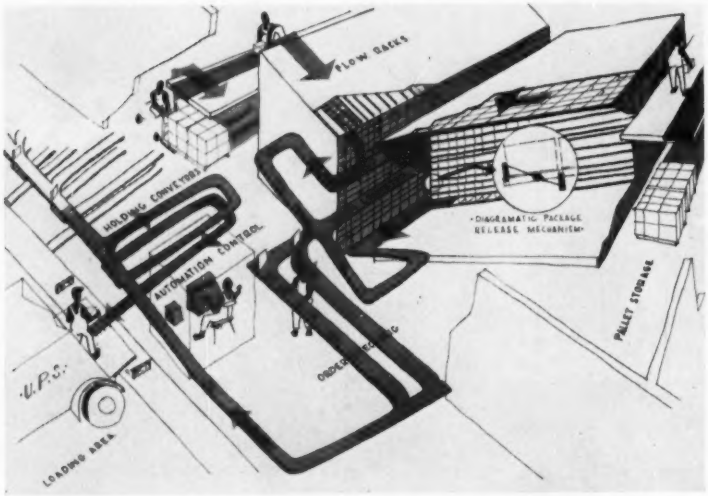
Materials handling projects sometimes require equipment design, as these two from TAB Engineers, Inc. illustrate. In one instance, a plant was storing only 864 cartons in 5000 sq ft of floor space because of wide truck aisle requirements. A new truck design permitted storage capacity to be doubled and increased the operator's efficiency by 25 percent. On another project, the over-all goal was to reduce the cost of building a home of brick. This led to a completely new system for handling brick, both on the job site and from the manufacturer's plant. TAB engineers designed a completely automatic brick bundling line that would count, stack, blend, paper wrap, and steel strap the bricks.

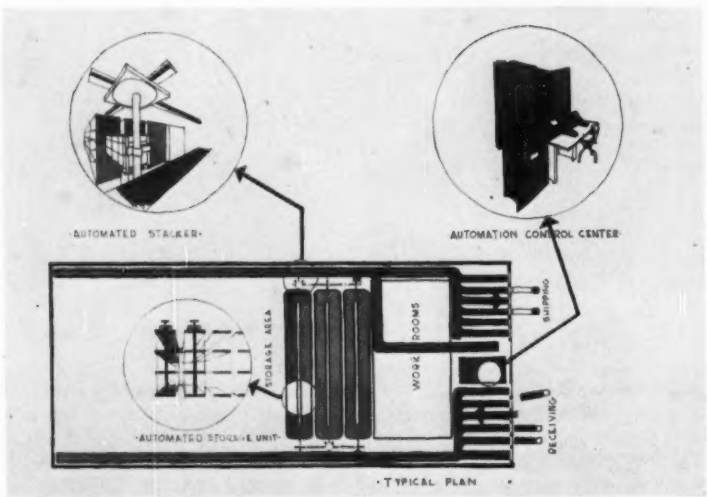


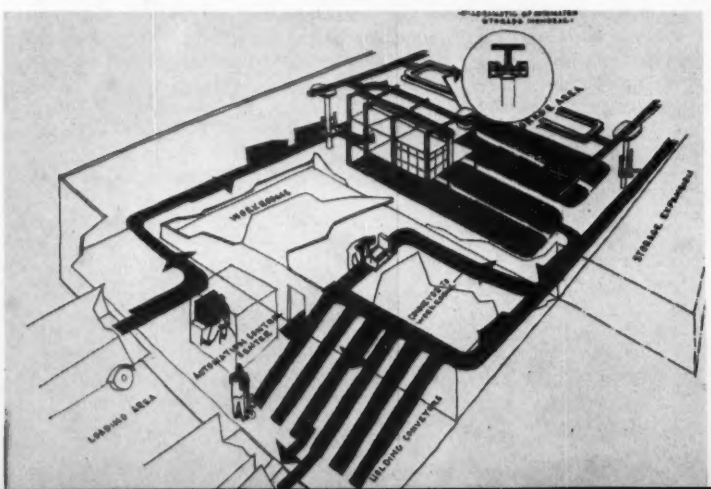
Richard Muther & Associates is an industrial management consulting firm, with about half of its work in materials handling and plant layout. On a project for the Jasper Blackburn Corporation of St. Louis, the big problem was to feed components to the assembly area and carry finished work away. The new layout shown here uses a simple belt conveyor system to carry work away from the assembly area to packaging, with automatic signals from the work bench bins signalling floor men to bring a new supply of components when an assembly station is running short. It is interesting to note from the layout that the fast moving items, which are produced in greatest volume, actually move the greatest distance. Mechanizing this movement with a simple conveyor system proved to be the key to economical handling.

Materials Handling

The Automated Warehouse







According to R. H. Tatlow III, president of Abbott, Merkt & Company, "It is never safe to predict the future; we never think big enough, nor do we properly foresee the great technological advances that are on the way . . . The automatic warehouse is entirely possible today. The design is not the problem, and we will see them in operation in the relatively near future. Like most things, money is the problem. Certainly this is true for department stores, where the savings-benefits ratio, as known today, will not justify high design and construction costs."

Shown in these sketches from Abbott, Merkt & Company are some of the basic concepts of the automatic warehouse. It will require complex electronic and electrical as well as conventional mechanical controls for flow racks, stacker cranes, conveyors, and even movable storage racks. Most of the mechanical handling equipment is already available. It is up to the consulting engineer to design a control system that will allow the automatic warehouse to be constructed at a cost that is compatible with its anticipated savings. It can be, and will be, done.

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De Marchi to Digges

The Military-Civil Transition

JAMES KIP FINCH, Dean Emeritus
Renwick Professor of Civil Engineering
Columbia University

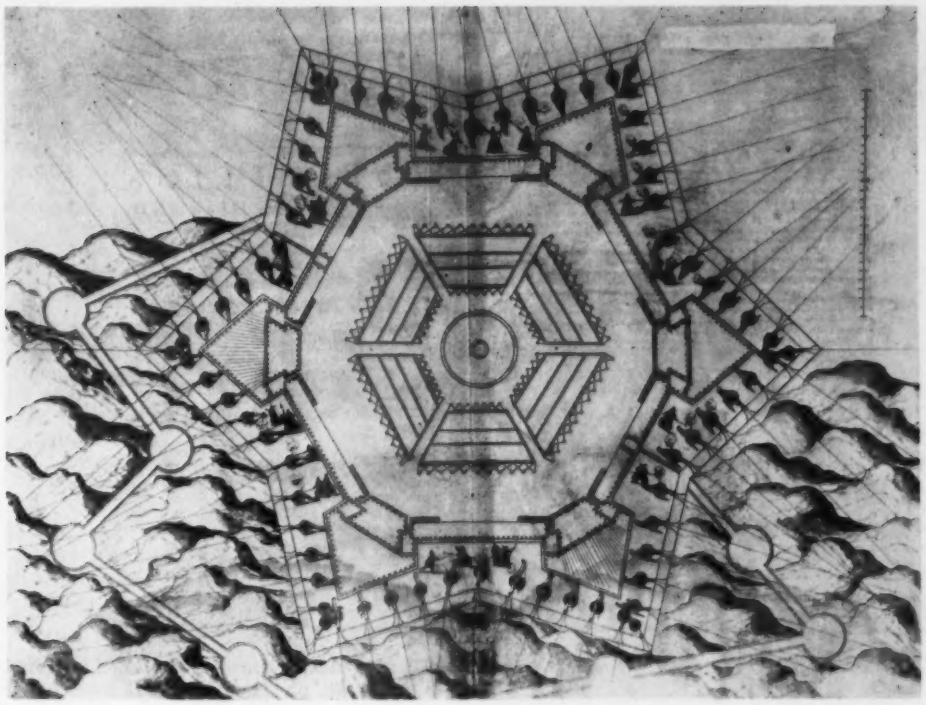
ALL BRANCHES of the profession owe a tremendous debt to earlier military engineers. "Engine" was the word first used to designate the catapults and other engines of war, and "engineers" were the men who made them and planned the medieval fortresses to withstand their attack. Military needs led to the development of new surveying instruments and methods, and problems of range and trajectory encouraged the birth of practical mathematics and mechanics well in advance of similar studies in civil engineering. In fact, the first printed book dealing solely with engineering was *De re militari*, by Robertus Valturius, published at Verona, in 1472.

Military needs also were a major factor in the development of machines. The casting of cannon stimulated further mechanical advances and the growth of metallurgy, notably in iron and its use. Queen Elizabeth was to brag that she left Britain with more iron cannon than there had been brass at the beginning of her reign. It was also a famous French military engineer and "Builder of Fortresses," Vauban, of the period of Louis XIV, who, in 1672, first proposed to bring engineers together in a professional group, called the Corps du Genie of the French Army.

When one turns, however, to selecting a work that reflects these developments in military engineering and their fertilizing influence, it becomes clear that no single book will do. Gunpowder had been used as early as 1350, but it was not until a century and a half later that the older catapults, scaling ladders, and walled towns, gave way to new weapons and new fortifications. Valturius belongs to the older order. The famous *Trattato dell 'architettura* of Francesco di Giorgio (1439-1502), also known as Martini, and a contemporary of Leonardo da Vinci, is clearly a transitional work. A painter, sculptor, and architect in his youth, later serving as municipal engineer of his home city, Siena, and becoming Duke Frederico's "foremost engineer and maker of machines of war," di Giorgio usually is credited with originating the polygonal star-shaped fortress that replaced the earlier castle. His book is a mixture of classical architecture and fortress plans.

De Marchi's Military Architecture

Another outstanding Italian military engineer from the 16th century, however, did produce a work in which masonry was used simply to support and retain the slopes and walls of relatively low, star-



One of more than 160 fortress plans illustrated and described in De Marchi's famous Architettura militare, *published in 1599. It indicates how the high stone walls of the medieval castle were replaced by low, largely earthwork walls, forming a star-shaped pattern for the cannon emplacements.*

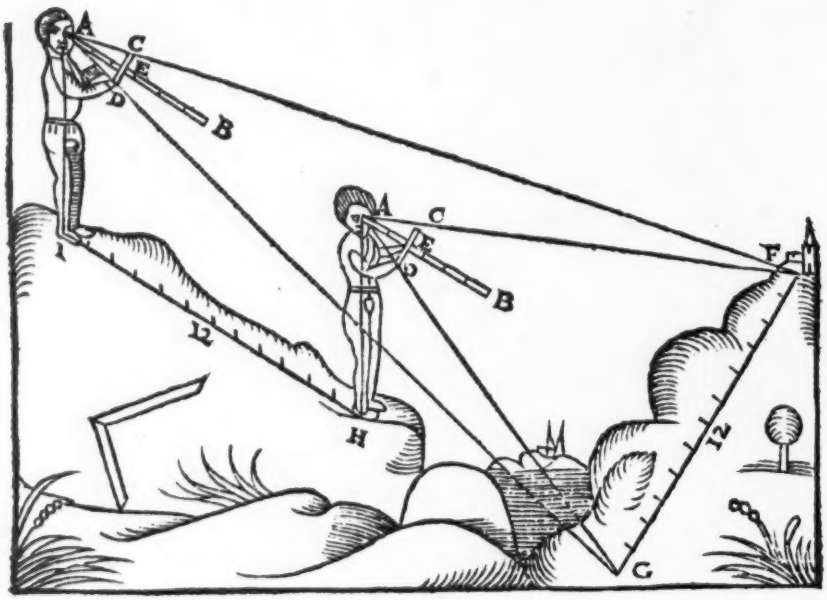
shaped fortresses built largely of earth. His book deals solely with fortress design and building. Francesco de Marchi (1504-1577) titled his work *Military Architecture,* but the trend of the times is indicated by the fact that he was not, like his immediate predecessors and the architects of his day, an artist of general training. He was a professional soldier with a limited education. *Della Architettura militare del Capitinio Francesco de Marchi, Bolognese, Gentil 'huomo Romano, Libri Tre* was first published at Brescia, in 1599, some years after the author's death. It was begun, he tells us, in 1546 in Rome, where he had acted as artillery inspector under Pope Paul III. Later he saw Spanish service in the Netherlands. The book is a huge and ponderous folio volume containing over 160 plates, almost all double page, of star-shaped fortresses for mountain locations, for the protection of a tower in a plain, for the sea shore, or even for an island. Books One and Two are texts dealing with the selection of sites, and specification of materials, design details, and supervision of the construction. Book three consists of the plates accompanied by suitable "expositione."

De Marchi's careful study of the placing of embrasures and cannon to provide not only complete coverage of the surrounding terrain, but also to permit cross fire, is impressive. He does offer some "historical excursions," as Staub calls them in his *History of Civil Engineering,* but seldom solely to impress the reader. He is an engineer, and he is writing for engineers.

"It is not advisable to fortify all cities, because too many fortresses cause great destruction in that they tend to lead to prolonged wars of siege. This is why wars last so long. In earlier times, when fewe places were fortified, the wars passed much more quickly, and were thus less costly to the sovereign in terms of money, and to the peoples in terms of destruction."

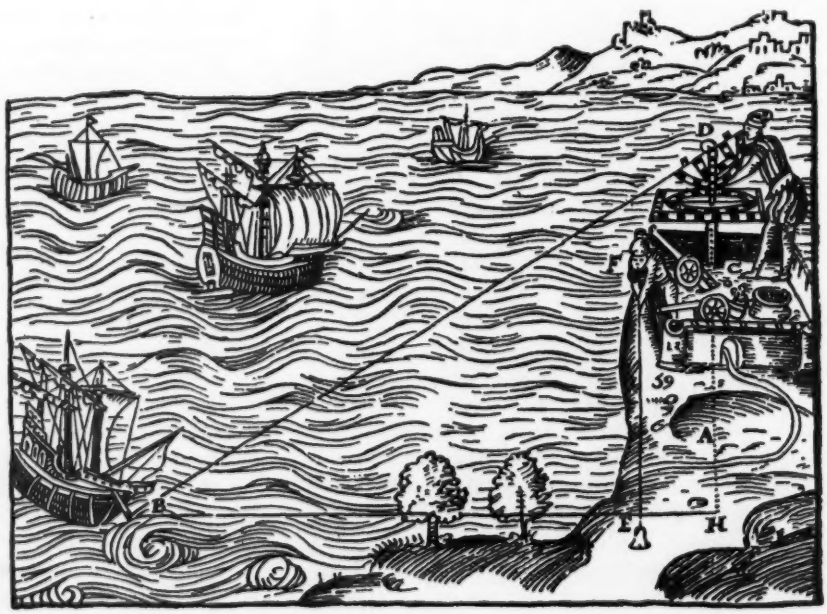
There can be no doubt that this work of De Marchi is one of the great books of military engineering. Vauban, in building the frontier fortresses of France (some of which played a part even in World War I) and also in the defenses of his major work (the harbor of Dunkirk), undoubtedly was influenced by De Marchi's plans.

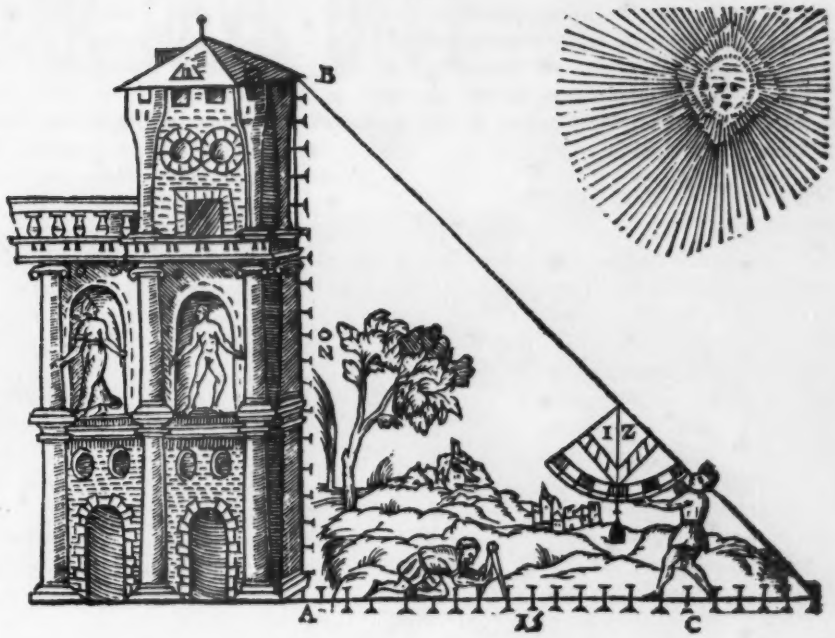
De Marchi, however, stuck closely to fortresses. One must turn elsewhere for comment on the problems and techniques accompanying the rise of the new engineering. In military surveying, selection of a single authority is difficult be-



Wood cut from Fine's De re et praxi geometrica, *published in Paris in 1556, illustrates what Digges called the "profitable Staffe." It could be graduated to measure angles, but was more commonly used to measure the length of an inaccessible object. Using the "two position" method, an observer selects a convenient point A and adjusts the cross piece on the main staff so it just covers the object. A similar sighting at a second point gives desired length.*

Digges describes the use of his theodolitus for measuring a distance using the tangent ratio thus: "Admit I stande on the cliffe A, and see the shippe B lying at rode in the sea, I desire to know how farre off she is from me . . . I turn my dimetient of my semicircle towarde the shippe . . . and therewithall I finde my perpendiculare cutting the thirde parte of my Scale, then measure I the altitude of the cliffe above the sea EF . . . so have I 60 pase the height of the semicircle above the sea, whiche multiplyed in 120 the side of the scale . . . and divided by 2 yeldeth . . . 2400 pase."





A page from Digges' 1571 volume shows the simplest form of the theodolitus. It is a simple horizontal circle divided into degrees and also with a geometrical square, and provided with a sighting arm. His later, more complete instrument had a vertical semicircle affixed to it.

cause of the flood of works which came from the early printing presses. To the English-speaking engineer, however, a small volume which appeared in London in the early Elizabethan Period is not only of special interest but reflects, in its quaint black-letter type and its early wording and spelling, the atmosphere of the age of British exploration, when Drake sailed and Shakespeare wrote. In 1571 there was "Imprinted at London, at the Signe of the Mermaid, by Henry Bynneman, a Geometrical Practice, named Pantometria, framed by Leonard Digges, Gentleman, lately finished by Thomas Digges, his sonne." Here, a surveying instrument is described — the direct ancestor of the European theodolite and its simplified offspring, the American engineer's transit. It was developed primarily for military use, and two other earlier instruments used principally in military surveying also are described.

Elizabethan Surveying Instruments

The baculum "crosse-staffe," or the Jacob's Staff, is of early but uncertain origin. The longer arm could be graduated to make the reading of angles possible, and it apparently was used for this purpose in early navigation. Its use in determining the dimensions of an inaccessible object, a frequent military problem, is an example of the application of simple geometry and the avoidance of calculations characteristic of the practice of the day.

Another popular device, the geometrical square, was undoubtedly a simplification of the ancient astronomical instrument, the astrolabe, which is regarded as having originated in early Babylonia. While quarter circles (quadrants) divided in degrees had early been used, the two sides of the geometrical square usually were graduated in 12 major divisions. Angles were read not in degrees but in terms of what we now denote as their tangent or co-tangent. Held vertically and equipped with peep sights and plumb bob this device was used, as Digges says, "Chiefly for altitudes and profundities," but, with a pivoted sighting arm, it also could be used for horizontal angles. The graduations of both square and quadrant frequently were combined in the astrolabe and in the surveying square that Digges calls "the Quadrant Geometricall."

Digges' *Theodolitus* was simply a Planisphere, that is, a full horizontal circle graduated clockwise into 360 degrees, inscribed also with a geometric square and provided with a sighting arm. But Digges further combined this with a vertical semicircle mounted on a central post attached to the sighting arm of the planisphere. He writes:

"It may seeme superfluous more to write of these matters, yet to finishe this treatise, I think it not amisse to shew how you may joyne these in one, whereby you shall frame an instrument of such perfection, that no manner altitude, latitude, longitude, or profunditie can offer it selfe, howsoever it be situate, which you may not both readely and most exactly measure."

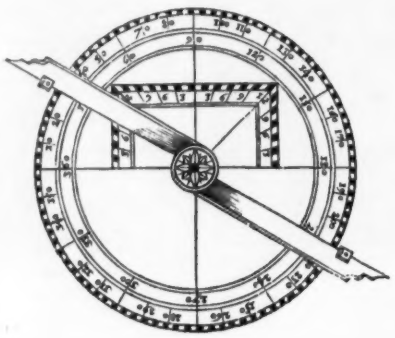
This "complete engineers transit" of 1571, suited to measure both horizontal and vertical angles, he

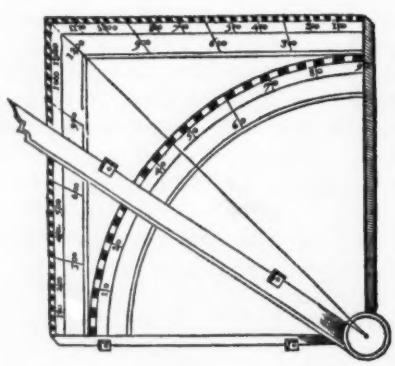
called his "Instrument Topographicall serving most commodiously for all manner mensurations." The name *Theodolitus* was soon transferred to this more complete, combination device. Mounted on a "staffe," its use is demonstrated in the woodcuts with which his book is illustrated.

Digges and Tartaglia

It now seems clear that Digges had either visited the Continent or had access to many foreign books, for a number of his illustrations also occur in earlier works. Actually, the pioneer German cartographer, Waldseemuller, had illustrated, as early as 1512, an instrument similar to the *Theodolitus*. He called it a *Polimetrum*.

In addition to his surveying contributions, Digges also discusses a major question of military mechanics – the trajectory of a cannon ball, a basic artillery problem. The earliest attempt to develop a mathematical basis for the art of gunnery was that of the Italian, Tartaglia, in 1537. The inclination of a cannon usually was determined by a simple form of geometrical square and attached plumb bob placed in its mouth, the "gun-quadrant." Tartaglia argued that the greatest range was attained when the cannon was raised to 45 degrees. The trajectory, he held, was composed of a straight line at the gun angle, followed at the highest elevation by the arc of a circle, which led to another straight line leading to the target.





Digges' "Quadrant Geometrical" and "Geometrical Square" were used to obtain tangents and cotangents.

Digges refused to go along with these ideas. "I have at last," he writes, "reduced that most irregular course and circute of the Bullet (framed and compounded of violent and naturall motions) within the bounds of numbers and Arithmeticall rules," and, he cautions, "This surely I will say, that as the ignorant in Geometricall and Arithmeticall proportions, shall never attaine perfection, though hee turmoil in powder and shot all the dayes of his life; so the Geometer, how excellent so ever he be, learning only to discourse of reason, without practice (yea and that sundrie wayes made) shall fall into manifolde errors or inextricable Laberinthes. Among many that I have read concerning that matter, I note one Nicholas Tartaglia an Italian," whom he accuses of having fallen into such errors.

Tartaglia is, in fact, even more strongly condemned by Digges' son Thomas in his *Arithmeticall Militare Treatise named Stratioticos*, of 1592, as "an excellent Geometer, yet who for want of Practise and Experience, hath erred even in first Principles." Nevertheless, even Digges' ideas were not correct, and this problem of the "Angle of the Randoms" and the "Arcke of the Bullet" remained to perplex artillery experts in later centuries.

Birth of Mechanics

A practical engineering mechanics was in the making, and these problems could not be met by either the artistic approach or by humanism, the turning back to classical times for inspiration and guidance, which was captivating the interest of the Renaissance architect of the day. The engineer was forced to find a more realistic, factual approach, and he sought continually to secure more accurate quantitative, mathematical evaluations, to develop a practical science of engineering. A divorce between military engineering and architecture as we know it today was thus inevitable, and in the end, Sweaton in Britain, about 1750, was to coin the title civil engineer as a further distinction between the work of engineers in military and civil life. Military engineering thus played not only a vital role in the rise of modern engineering techniques but in the evolution of engineering as a profession separate and distinct from its ancient sister profession of architecture.

Unfortunately there is no translation or even a modern edition of De Marchi's work – it remains one of the rare books of engineering. Digges' description of the *Theodolitus*, some 60 pages with illustration, forming the first book of his *Pantometria*, was published by J. Johnson, for Oxford University, in 1927, but is now out of print. The other works of Leonard and "his sonne Thomas" exist only in their rare early editions. ▲▲

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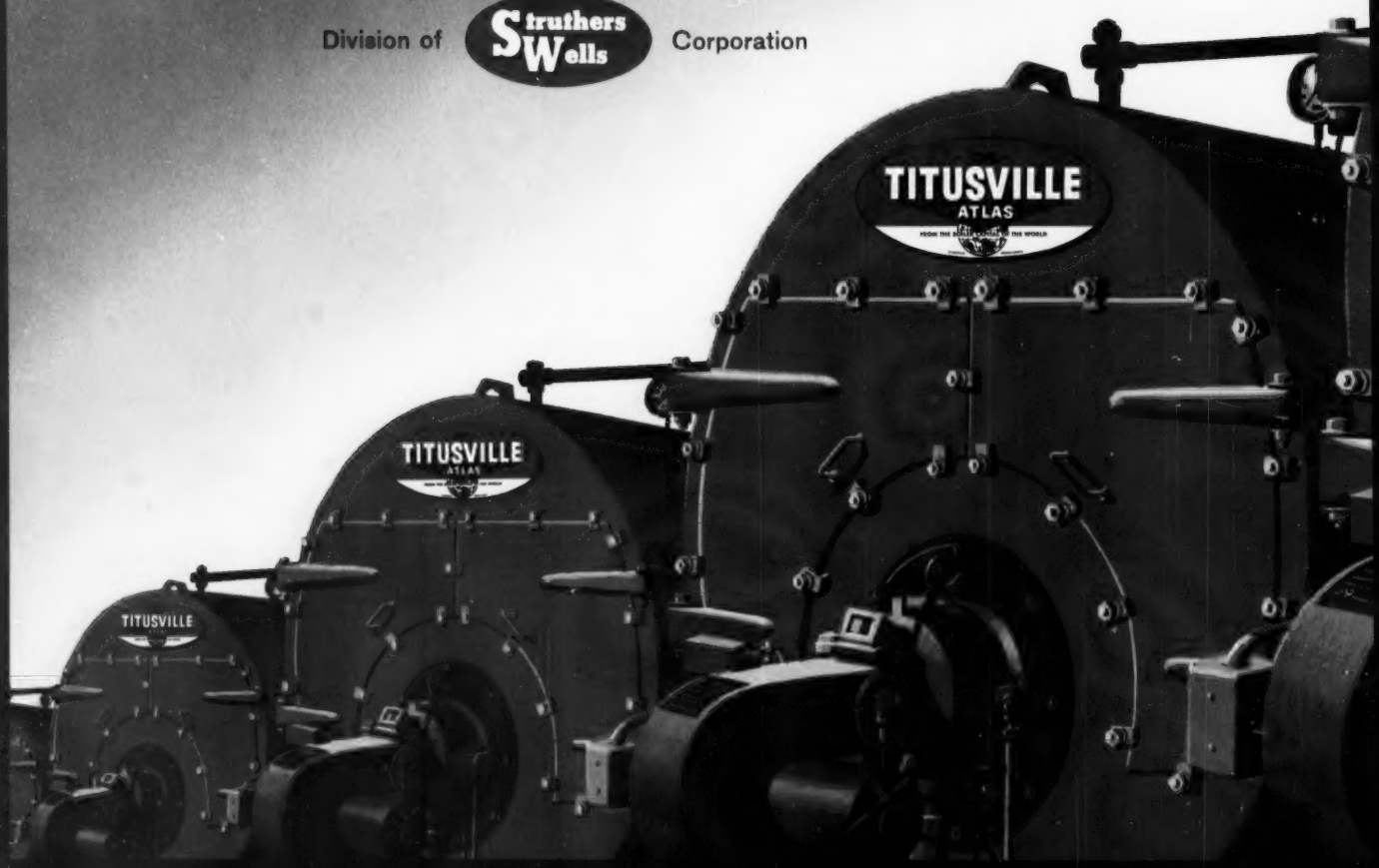

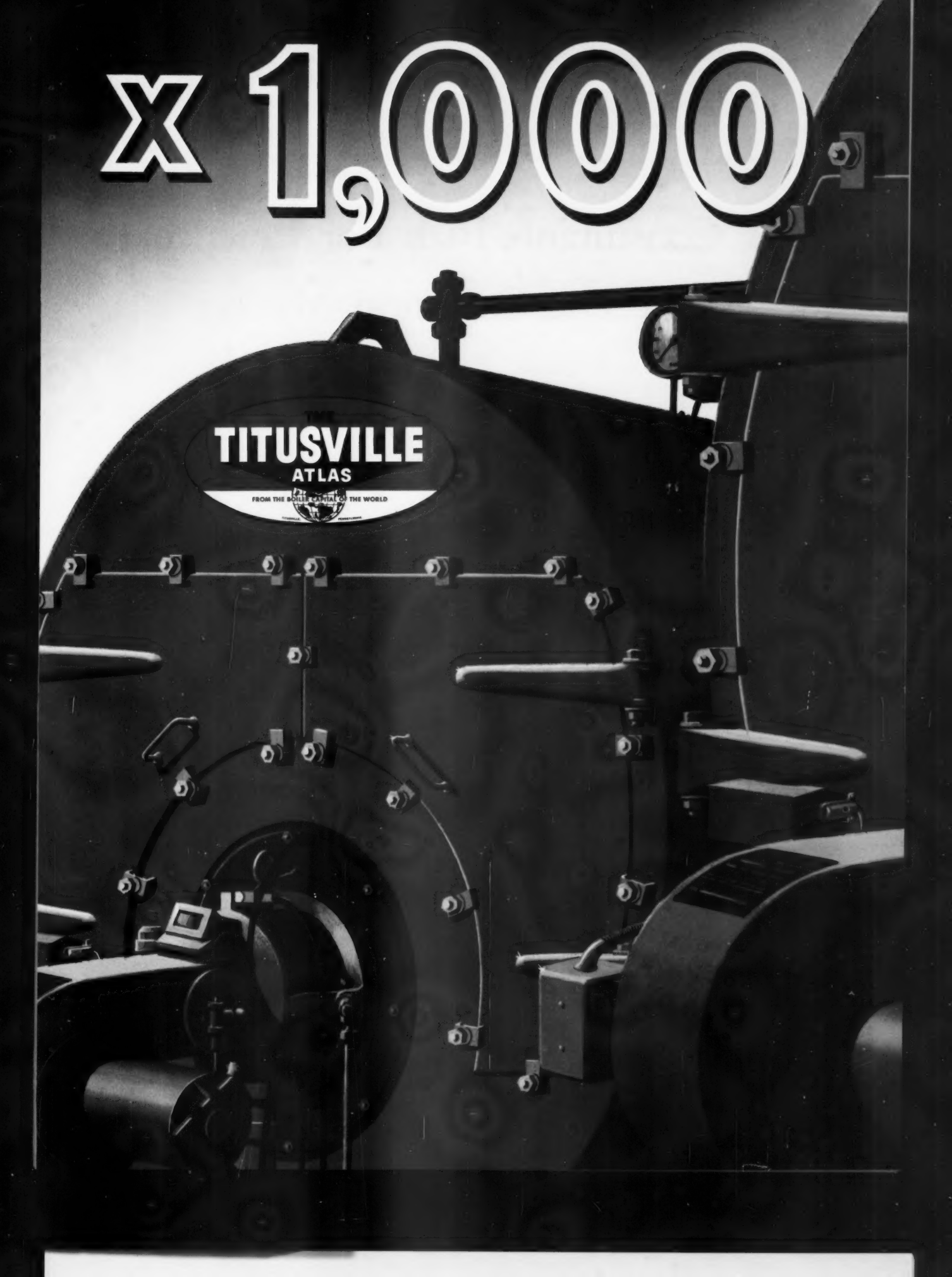
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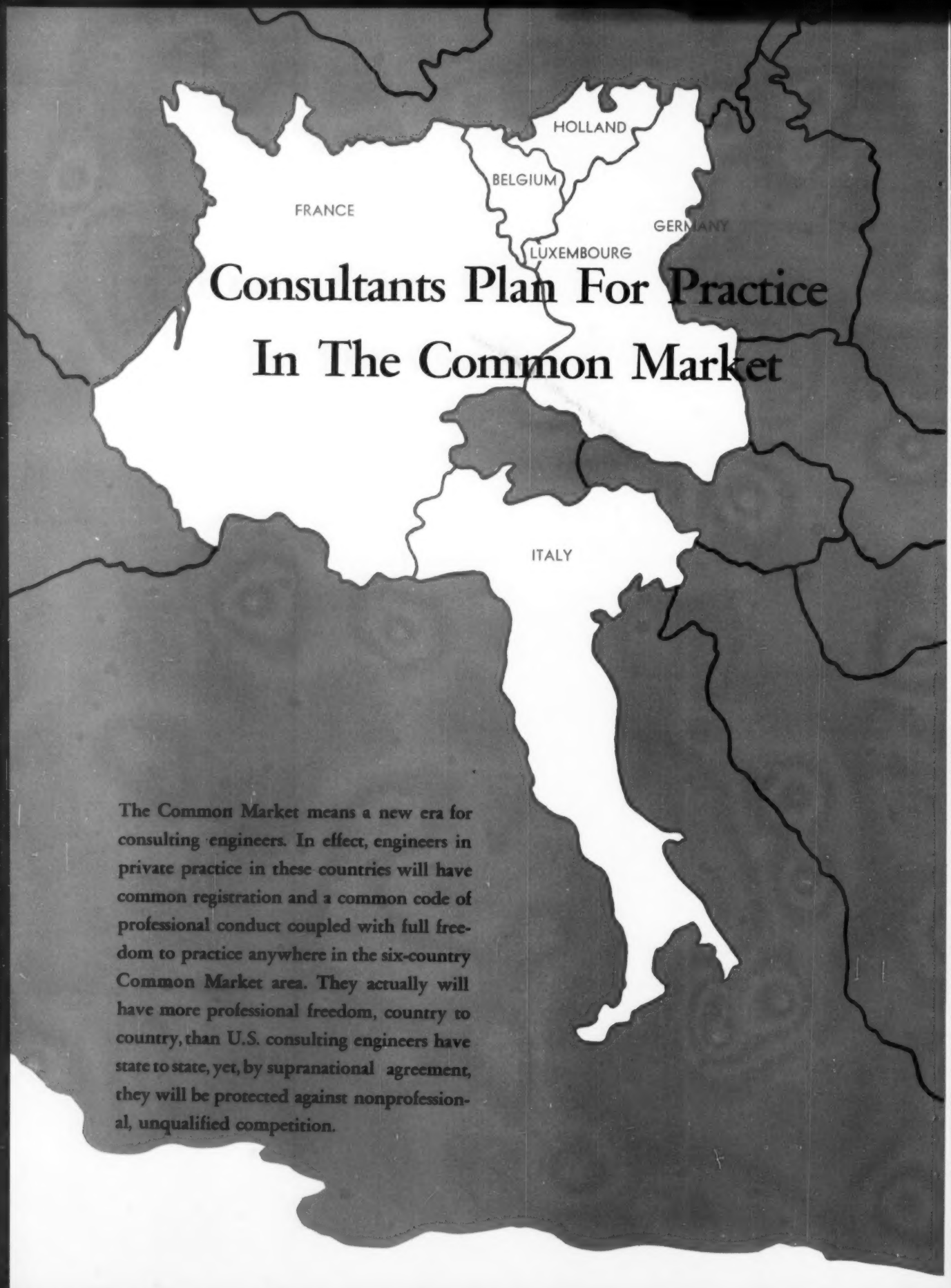

Consultants Plan For Practice In The Common Market

The Common Market means a new era for consulting engineers. In effect, engineers in private practice in these countries will have common registration and a common code of professional conduct coupled with full freedom to practice anywhere in the six-country Common Market area. They actually will have more professional freedom, country to country, than U.S. consulting engineers have state to state, yet, by supranational agreement, they will be protected against nonprofessional, unqualified competition.

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BY THE TIME the European Common Market comes into full force, Europe should have a unified consulting engineering profession. The highly heterogeneous practitioners of five countries — France, Germany, Italy, Belgium, and Holland — will have been merged into one body. (The sixth member country, Luxembourg, has no universities and hence no engineers, according to the most widely accepted definition of the term.) The five national professional groups will be subject to a common code of ethics concerning professional conduct, and will, if present plans can be carried into effect, be entitled to carry out their work as engineers only when they satisfy certain academic and other strict requirements. Having satisfied those requirements, however, they will be at liberty to practice their profession in any of the six countries of their overseas territories without fear or discrimination of any kind.

These changes will take them a long way from their present position. The national differences that exist today are numerous and some are of the utmost importance. In size the professional groups vary tremendously. Whereas the Dutch professional association has only about 100 members and the Belgian 80, the other three countries have much larger associations. Precise figures are extremely difficult to obtain, but informed estimates put membership of the French Chambre des Ingenieurs Conseils at 800, with the German association slightly larger, at about 1000. The Italian position is a good deal more complex since Italian architects and engineers are listed together on the official register and together number over 45,000. Of these almost 10,000 are, it is claimed, consulting engineers, but it is doubtful whether anything like this number actually are in private practice. Since there is no legal or professional distinction between consulting and employee engineers, the true figures must remain in doubt.

The present conditions are seen to be even more complex when it is realized that members of the national associations of consulting engineers constitute only a part of most of the engineers in private practice. In countries such as Italy, it is true, the rules are strict; it is an offense for anyone not on the register to use the title of engineer or to practice engineering, but elsewhere, registration is unknown. In France there is, in addition to the 800 members of the Chambre des Ingenieurs Conseils, a growing number of engineers organized in companies and known as *bureaux d'études*. These are grouped in the Chambre Syndicate des Bureaux d'Etudes, and each offers a complete range of engineering services to its clients. In the Netherlands and Belgium, also, some consulting engineers practice independently of the association, although their number is believed to be small.

Profession Needs Definition

Further complications arise out of the vagueness of the definition of "consulting engineer." In the Netherlands and in France, anyone at all can adopt the title either of engineer or of consulting engineer and carry out the work of that profession without legal interference; many Dutch "consulting engineers" are in fact manufacturers' agents and dealers in machinery. In view of the extreme laxity with which the term is applied in some of the six countries, it scarcely is surprising that it is impossible to form a precise estimate of the total number of engineers in private practice.

Nor is it surprising that the various sections of this embryonic "European" profession await the full establishment of the Common Market with very different expectations. Even so, there is a noteworthy absence of pessimism. The worst that is expected is a continuance of present conditions. As far as the total volume of work within Europe is concerned, the general opinion is that the advent of the Common Market will have little effect upon it. The possibility that there will be a greater number of development projects in the more backward parts of the Market, especially in the south of Italy, is acknowledged.

However, it is expected that in the French overseas territories there will arise great opportunities for the profession. Investment by the central authorities of the European Economic Community may well center upon the underdeveloped African territories, and it is precisely in such areas that engineering firms often are presented with their biggest projects. There is some fear, especially in Italy, that the French will tend to monopolize the work in the African countries. The recently-created organization, Dicofrance, the object of which is to combine the services of several consulting engineers to work abroad, is regarded in some circles as potentially dangerous in this way. Still, it seems probable at present that where engineering projects are to be financed by the Common Market's supranational bodies, consulting engineers from at least two countries will be called on to participate. Even if the volume of work grows less rapidly than is expected, it is clear what type of work will expand most in the next decade. The demand for engineers in the overseas territories will derive very largely

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from the need to build dams, railways, roads, pylons, and mines. More interprofessional engineering work, with its office blocks and schools and hospitals, will well follow but rather more slowly.

Competition to Force Mergers?

One question exercising the minds of a number of European consulting engineers, not least in Germany, is whether the removal of all national barriers against the practitioners of the other Common Market countries will result in intense competition, or in a series of mergers and amalgamations between consulting engineering firms and individuals. Probably the final outcome will embody both trends. Clearly, the individual consultant will not be well placed to face competition from the firms of several nations, and it may well be that the German and French tendency for consultants to group together in firms will become widespread. On the other hand, none of the six countries have yet witnessed any amalgamations that properly could be called the result of the formation of the Common Market, and in the Netherlands any such move is thought unlikely. Associations between firms for the purposes of a specific project currently are not unknown and probably will continue; but more permanent links, especially of an international character, do not seem a very strong possibility.

To say this is not to overlook the important link that already exists between many consulting engineering firms, not only in four of the six Common Market countries, but also in Denmark, Finland, Britain, Norway, Sweden, and Switzerland. FIDIC, or the International Federation of Consulting Engineers, was set up in 1913 as a link between professional associations in each of the member countries. It remained entirely European until last year when associations of South Africa, Australia, Canada, and the United States were admitted to membership. Its aims were to encourage the setting up of uniform rules and standards in the profession and, more generally, to promote the business and professional interests of its members. The Federation is, however, a purely voluntary organization and as such can do nothing to enforce its decisions. In many respects the Common Market will be bringing about a great many of the changes which it has been the aim of FIDIC to promote. But even today it remains a matter for serious doubt whether they can be achieved at all.

This is so because it is not yet certain that attempts at the creation of a "European" profession will be successful. First, the Common Market countries are not all there is to Europe. And even within the six there is a lack of harmony. Disagreement between Italy and France is particularly strong. This fact was re-emphasized in January at a meet-

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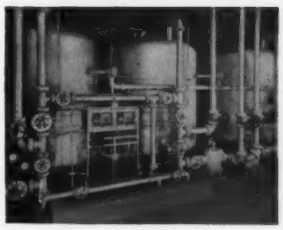

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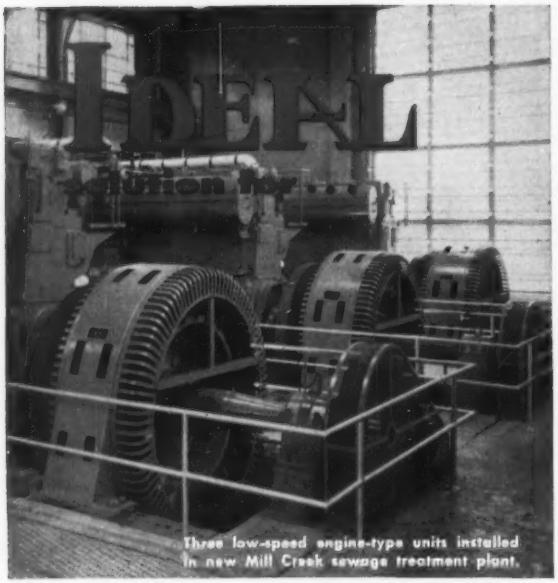

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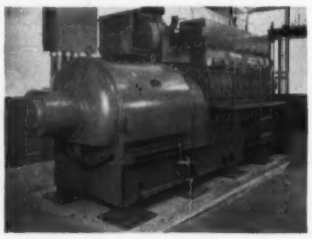

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ing of FEANI, the European Federation of National Associations of Engineers, at which the intractable problem of creating a European register of engineers was discussed.

The issue concerns professional qualifications. The Italian point of view is that the register should include only the names of people who have a university degree in engineering. The French objected to this because such a regulation would amount to a disqualification of a great many people at present practicing as engineers in France. In fact only graduates of France's 22 Grandes Ecoles would be entitled to register. A temporary solution was in the end reached although its implications are as yet by no means clear. What will happen is that each of the six countries is to draw up a list of the degrees which it is prepared to admit as qualifications for registration on the European roll. Each degree then will be voted upon, and only those securing the support of at least five of the six countries will be officially recognized.

In these circumstances, it seems unlikely that the French will be able to insist on their position, since the Italians have to secure only one ally in order to prevent the recognition of qualifications below university standard. This they are quite determined to do. The firmness of their determination arises from the peculiar strictness of existing Italian law on the subject of engineering projects. This requires all plans for such projects to be signed by an engineer or architect. The interests of those professions thus are protected from competition from other sources. What the Italians fear is that a relaxation of the law following the recognition of inferior degrees may result in the invasion of the Italian market by large numbers of less than qualified French competitors who will charge lower fees. So the issue remains in doubt for the moment, but is likely to be resolved in the next year.

Private vs. Government Engineers

One source of anxiety that is a good deal more familiar to the European profession, but which does not give rise to quite such strong feelings as the question of qualifications, is the share of the available public work handled by consulting engineers. This does not, however, constitute a major headache for private practitioners, and there is no general fear that publicly-employed engineers will encroach more and more upon what has hitherto been private territory. On the contrary, insofar as anyone is willing to express an opinion about the effect of the Common Market upon the public-private tug-of-war, there is some feeling that the private practitioner may benefit a little. In France, particularly, the hostility with which consulting engineers regard publicly-employed engineers is

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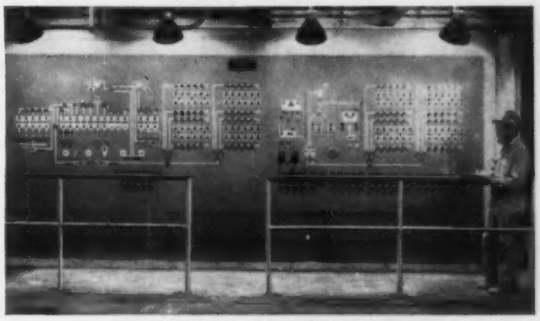

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likely to insure that no work goes unnecessarily to government employee engineers.

There has been some talk of the creation of huge *bureaux d'études*, or public corporations of some kind, to deal with the engineering projects of the Common Market as a whole. This suggestion has, needless to say, met with fierce opposition both from FIDIC and from its individual members, and the immediate chances of its adoption are slight. But it is a scheme to which statesmen of the European Community may at some future date decide to resort, and so must remain a permanent though distant cloud on the horizon of engineers in private practice.

In those countries where there is least anxiety on account of the encroachment of government employee engineers, the reason is usually that the fields of operation for both sections of the profession are clearly defined and adhered to. For example, in the Netherlands the huge public authority, Rijkswaterstaat, which deals with the country's defenses against the sea, as well as with roads, railways, waterways, and the post office, is quite unassailable in its own field. Yet it never makes any attempt to extend its activities beyond these conventional bounds. The only private-public competition in Holland is between the small local authorities and private consultants. The slight tendency for government employee engineers to expand their spheres of operation is noticeable also in Belgium, where work taken by public employers damages the interests of the private practitioner. It is not claimed, however, that the threat from local authorities is serious or growing.

With a few reservations, therefore, the new European consulting engineering profession has little cause for anxiety as a result of the inception of the Common Market. Its chief worries have nothing to do with the current moves towards economic integration in Europe. They spring much more from long-term trends in the volume of work available and in the attractions which consulting engineering holds out to young graduates.

Shortage of Projects?

As far as the real volume of work is concerned, the inquirer is apt to be faced with a great mass of contradictory claims and counterclaims. On the one hand it is impossible to escape vociferous complaints in every one of the six countries that there is an acute shortage of all kinds of engineers. At the same time, there are frequent references to the shortage of work for consulting engineers. This apparent contradiction probably is explained to some extent by the fact that there can be no certainty how many people practice as consulting engineers in Europe. In some countries engineers in industry

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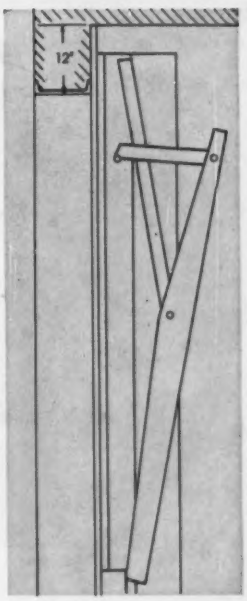

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or engineers in government undertake consulting work after hours, thus depriving the full-time private consultant of work which he regards as rightfully his. Also, it is hard to escape the conclusion that consulting engineering is less undermanned than most other branches of the profession. And thirdly, of course, some of the complaints about shortages of work may apply only to particular firms and may be exaggerated by overanxiety.

The fact of the matter is that in most of the six countries the size of the profession has risen, though slowly, over the last few years. Similarly there is general agreement that the volume of work is rising and may be expected to continue to do so. As the profession's expansion is only gradual, difficulties of recruiting enough young graduates are of only secondary importance. It is true that prospects in government employment are better. Not only is a much greater degree of security offered, but government salaries are very good and the chances of promotion promising. It appears, too, that the possibility that consulting work will involve prolonged tours abroad in uncongenial climates acts as a deterrent to a fairly high proportion of young engineers.

Cautious Confidence in Future

Nonetheless, with the possibility of ultimate independence acting as a great incentive, only in Germany and the Netherlands is there any prospect of more than a temporary shortage of young recruits. In Italy, indeed, a surplus seems quite a real possibility. Ironically enough, the chief reason seems to lie in the fact that by demanding a high level of qualifications (and also excluding from practice those who have not reached that level) the Italians have made the profession more, and not less, attractive. The hurdles to be surmounted may be higher but the extra rewards at the winning post have more than compensated for this disadvantage. A further factor in increasing the attractions of the profession is the extension of consulting work, which until recently was carried on almost entirely in the field of civil engineering, to mechanical, electrical, chemical, and other fields. In Italy, therefore, the profession's prospects seem especially bright.

Elsewhere, however, there is an underlying feeling of modified confidence. The consulting engineer knows that in the long run he is working in an expanding field. He has not, at least during the last decade, had serious cause for concern on the score of governmental interventions or regulation. He is confident that when current transitional difficulties are overcome he will be able to practice his profession in a wider and more prosperous market than Europe has known before. ▲▲

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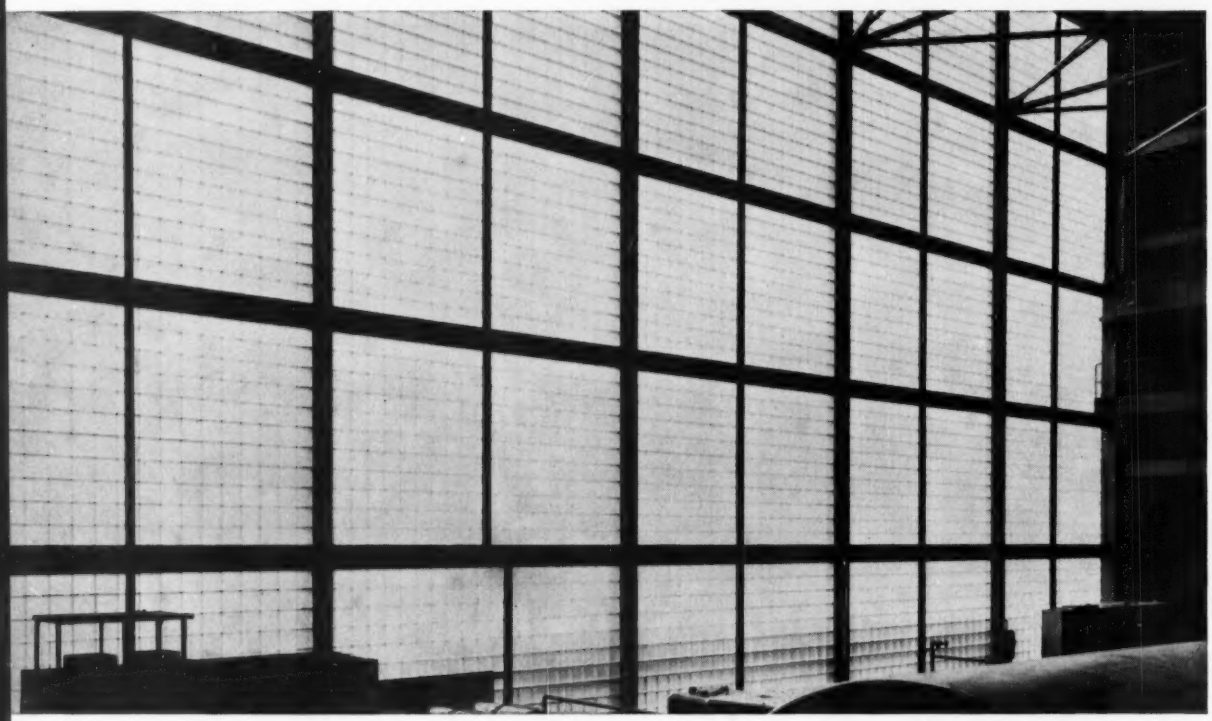

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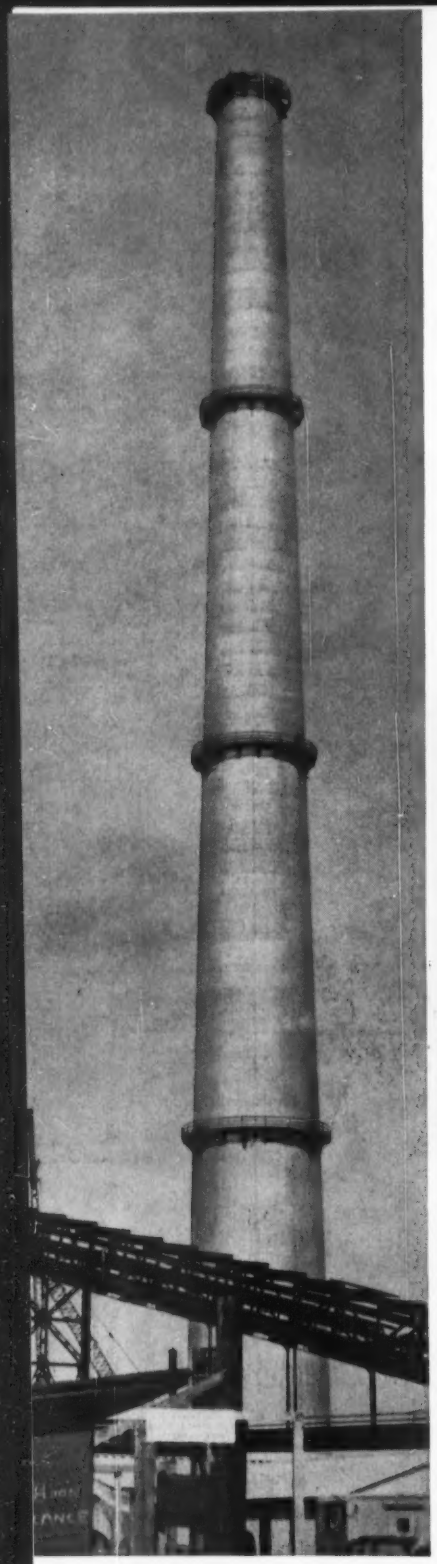

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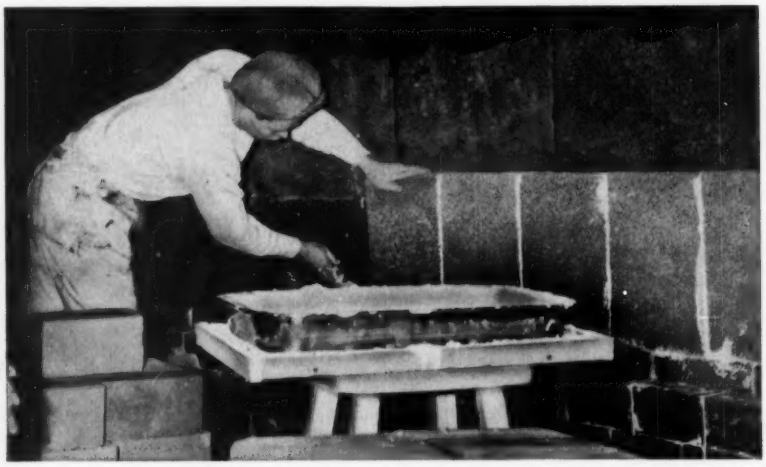

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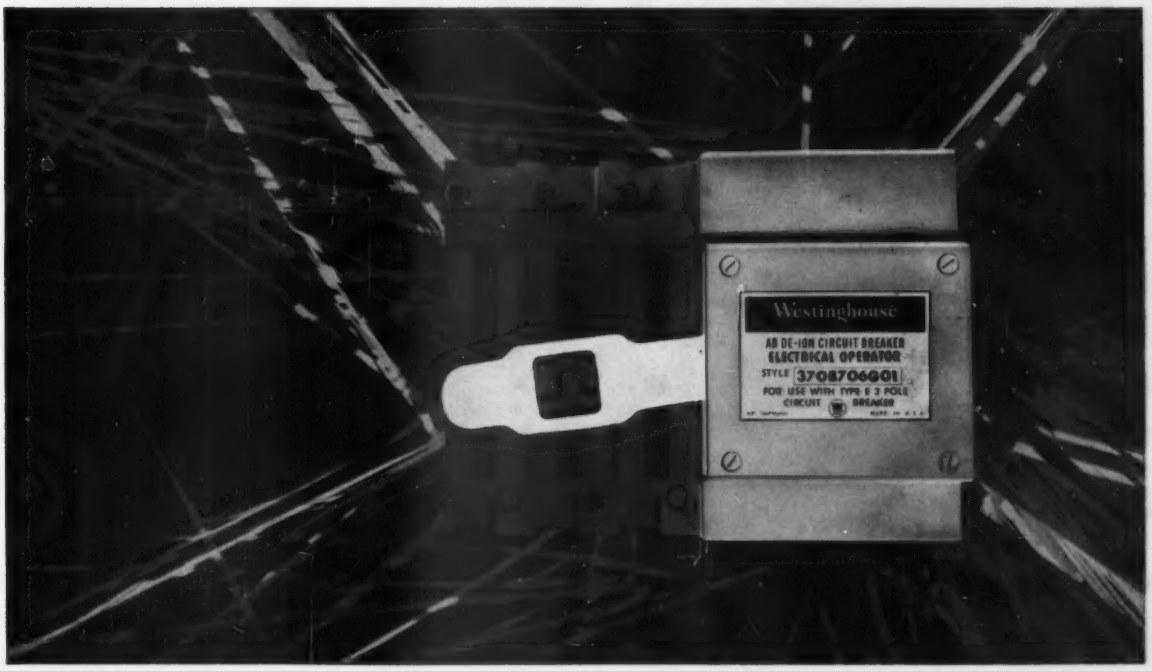

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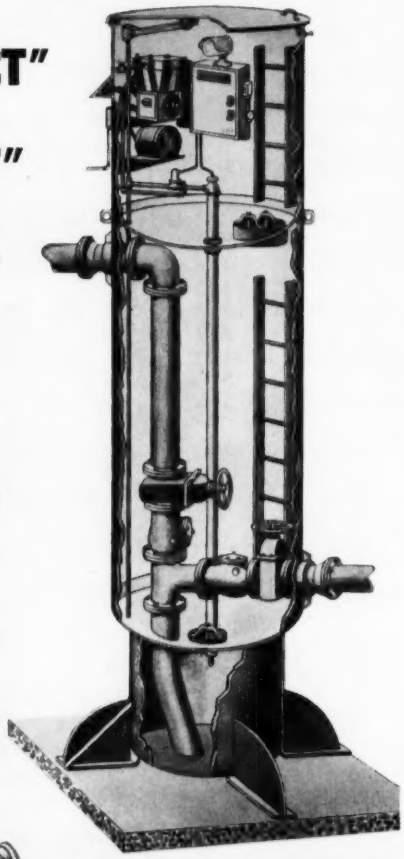
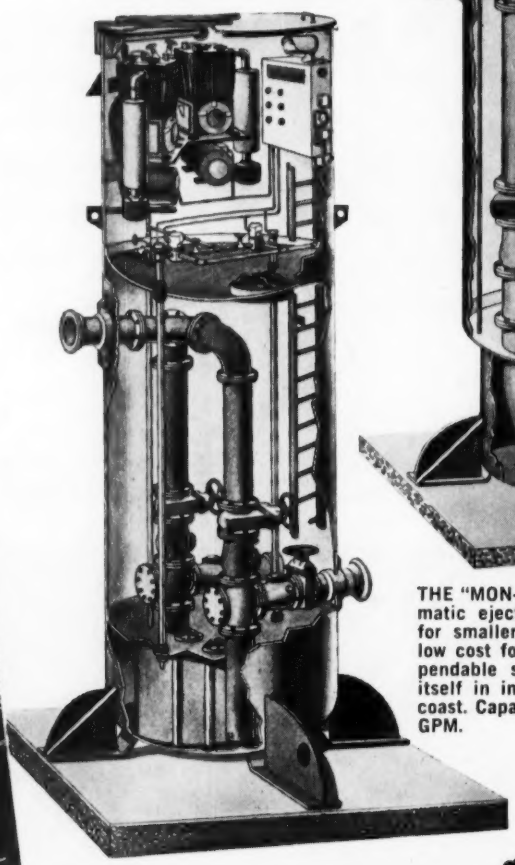
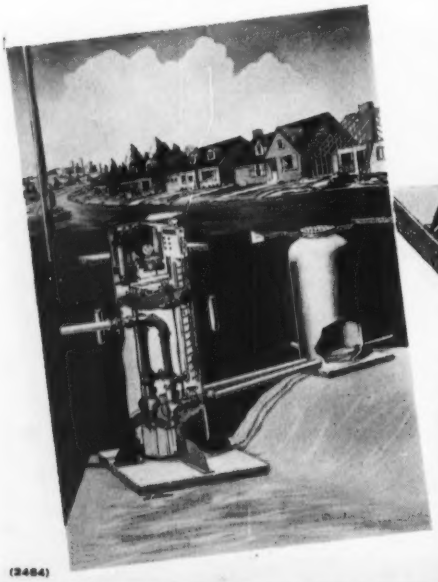




THE "MON-O-JECT" is a single pneumatic ejector lift station, designed for smaller capacities. Available at low cost for small projects, this dependable simplex unit has proved itself in installations from coast to coast. Capacity from 30 GPM to 200 GPM.



THE "DU-O-JECT" is a duplex pneumatic ejector lift station similar to the Mon-O-Ject" but with two compressors and two receivers for stand-by dependability or extra capacity at peak loads. Available in capacities from 30 GPM to 200 GPM, the "Du-O-Ject" combines dependable operation with minimum annual maintenance in a compact sewage lift station.

Also **WRITE FOR DETAILS ON THE NEW "VAC-O-JECT"**

...a minimum-size station designed for installation in a 4-foot wet well or receiving manhole. Utilizes both vacuum and pressure to give 2-stage lifting action — at the lowest cost.

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Plant: Lenexa, Kansas

J. S. Burk and C. C. Barnard discuss the details of a project between flights.

Private Plane Improves Client Service

BARNARD AND BURK, INC., of Baton Rouge, Louisiana, is a firm of consulting engineers offering a variety of engineering services to both government and private clients. The firm is located in the south central portion of the 16-state area it serves, an area in which there are, unfortunately, inadequate travel facilities connecting many of the communities. The principals and their engineers found they were spending a disproportionate amount of time in travel, and after much study, they decided to get their own private plane.

They bought a six-passenger Aero Commander 680 in May 1957, and during the two years of operation have flown it more than 1000 hours. During the first year 480 hours were logged on the aircraft, and in the second year 544 hours were added.

Plane Usage

J. S. Burk commenting on the firm's use of the airplane says, "Since 50 percent of our landings are at fields not served by the airlines, our plane fills a definite need. Its dependability has been outstanding. Only two of 1014 flights during the two years were delayed because of engine or mechanical trouble, and none were cancelled. Nine of the 1014 flights were cancelled by weather, so our scheduling was maintained over 99 percent of the time."

According to Burk, a typical log entry for a flying day might show:

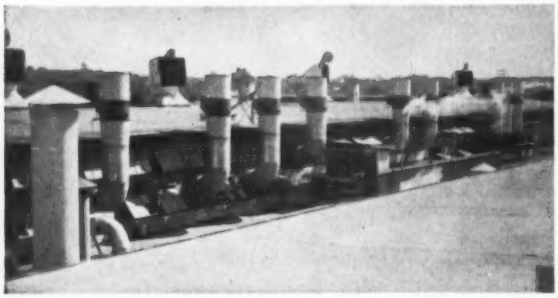
At 8:30 a.m. the airplane departed Baton Rouge with David Carville, mechanical engineering department manager, and W. Bill Hazlip, section leader. Flying the plane was Leon Purdin, chief pilot for the firm. The group arrived at Eunice, Louisiana, 95 miles west, at 9:00 a.m. where the Barnard and Burk field engineer met the aircraft. The company personnel inspected construction of a sewage collection system and checked other sections of the town's sewer.

At 11:00 a.m. Purdin, Carville, and Hazlip took off for Baton Rouge, arriving at 11:25 a.m. to pick up Jack Dyer and George Landry, both mechanical engineers, and Dan Cockrell, structural engineer, who were at the home office during the morning. That group left at 11:30 a.m., arriving 30 minutes later at Houma, Louisiana, 90 miles southeast.

After lunch, Hazlip, Dyer, and Cockrell obtained field information for design of an addition to a

the downturn

and upturn at KVP



Same picture – different setting. Top shows complicated, space-wasting duct system which routed fumes back into plant for discharge through stacks. Bottom shows nine new 36" Aerovent "SP-7" Duct Fans installed to take fumes *up* and *out*, saving valuable floor space in busy working area. Just one of hundreds of successful Aerovent installations characterizing modern air engineering in action.

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water treatment plant. Landry witnessed performance tests on three dual-fuel engine-generator units. Carville visited the power plant for a session with the city's utility superintendent.

The airplane left Houma at 4:30 p.m., arriving at Baton Rouge at 5:00 p.m.

After working a full day at the office, C. C. Barnard came to the airport at 5:45 p.m. and left in the Commander for New Orleans where he boarded a commercial airliner for a trip to New York. The plane returned to Baton Rouge, arriving at 6:45 p.m.

Six men had been transported on five jobs, saving a half day of travel for each of the staff men plus several hours of a principal's time with no wasted layover time and a much less tiring total trip. The total flying time for the day was two hours and 40 minutes.

The plane has made as many as 13 flights in one day and has had many six and eight flight days.

Burk was asked if the use of an airplane had contributed any new projects. "No doubt about it," he replied, "aircraft ownership helped us obtain a military contract for 17 Second Air Force bases. Without the airplane we would not have been able to undertake the design and supervise the construction work on so large a project."

Operating Costs

The pilot's figures indicate that the cost of operating the twin-engine Commander is $127 per hour, including depreciation, hangar, utilities, his own salary, and all incidental costs. The plane uses 39 gallons of gasoline per hour at 65 percent throttle, which is the normal cruise setting.

During one year's operation the plane averaged 182 mph, ground to ground, with an average trip length of 54 minutes. Fifteen percent of the trips were made at night and 18 percent required instrument flying. In two years it carried 2368 passengers.

Planes Merit Consideration

Barnard and Burk have the type and size of practice that can use a private plane efficiently. Most consulting firms who practice over a large area and have several concurrent projects requiring regular supervision are in the same position. The economics of ownership (as opposed to leasing) of an aircraft might be a matter involving the firm's tax position. A corporation, for example, might find it advantageous to own its own plane while a partnership might be money ahead to lease one. Another consideration would be the size of the firm and the number of principals and employees who travel. These factors require study before a decision can be made but they are tangible and can be measured in dollars and manhours. ▲▲

REDUCED MAINTENANCE
BETTER VISIBILITY

DIAMOND
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Bi-Color Gauges

MODEL 1050 MULTI-PORT
For boiler pressures up to 1050 psig.
Vision length—5 port—12⅜" and 7 port—18". Longer vision lengths easily obtained by adding 18" or 12⅜" sections for necessary length.

- SMALL ROUND PORTS INSTEAD OF LONG GLASS AND MICA STRIPS
- GAUGE NEVER REMOVED FROM BOILER FOR GASKET CHANGES OR OTHER NORMAL MAINTENANCE
- STEAM SHOWS RED
- WATER SHOWS GREEN
- COMPLETE PORT CHANGE REQUIRES ONLY ABOUT 15 MINUTES
- EACH PORT THERMALLY INDEPENDENT

MODEL MP-3000 MULTI-PORT
For boiler pressures up to 3000 psig.

Note These Features:

- **Less Maintenance — Greater Availability — Ports seldom need changing.**
- **Thermal Stability — Warm-up in minutes instead of hours.**
- **Ports are 1⅛" diameter on MP 1050 Gauge.**
- **Gauge body machined from a solid block of stainless steel. Welded tube and flange connections.**
- **"Hi-Lite" Illuminator — More visibility with less cleaning.**

The individual glass disks provide inherent thermal stability not obtained in the continuous vision gauge which requires the long glass and mica. Thermal stress is much less troublesome and damaging. Small mica disks cost less, and are not subject to wrinkling or cracking. Any port — glass, gasket and mica — may be replaced in minutes without removing the gauge from the boiler. Torquing operations are much less critical, and warm-up period is minutes instead of hours.

The Bi-Color feature makes reading sure. By an invariable optical principle, steam always shows red, water green. Changes in level show instantly. 8302

For a trouble-free gauge that makes reading of water level sure and easy — Diamond Multi-Port Bi-Color —

Write for

Bulletin 2044-A for pressures up to 1050 psig
Bulletin 1174 for pressures up to 3000 psig

DIAMOND POWER SPECIALTY CORPORATION
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Coal cuts fuel costs $5200 a year

Hinsdale High School uses just 1450 tons of coal a year, saves on fuel and handling costs

When Hinsdale Township High School, Hinsdale, Ill., was designed, an engineering survey on the cost of steam generation was conducted simultaneously. (Steam would be used principally for heat, hot water, swimming pool and laundry.) The survey dictated the selection of coal for lowest fuel costs and a completely modern coal-fired plant was designed for maximum efficiency and economy. Today, outstanding features of this coal burning plant are: one-man operation, economy in labor and fuel, mechanical coal and ash handling and low maintenance costs. The decision to use coal saves this relatively small coal-burning plant $5200 in fuel costs annually over the nearest competitive fuel.

COAL IS LOWEST COST FUEL

Today, *when the annual cost of fuel often equals the original cost of the boilers,* you should know that bituminous coal is the lowest cost fuel in most industrial areas. And modern coal-burning equipment gives you 15% to 50% more steam per dollar, while automatic operation trims labor costs and eliminates smoke problems. What's more, tremendous coal reserves and mechanized mining procedures assure you a constantly plentiful supply of coal at stable prices.

TECHNICAL ADVISORY SERVICE

All companies planning a new power plant, or the remodeling of a present one, should consult an engineering firm on its design and construction. As a matter of fact, every Bituminous Coal Institute advertisement advises its readers to take this step. When you have such a project, our Engineering Staff will be glad to assist you in your fuel cost survey with any coal information you may require.

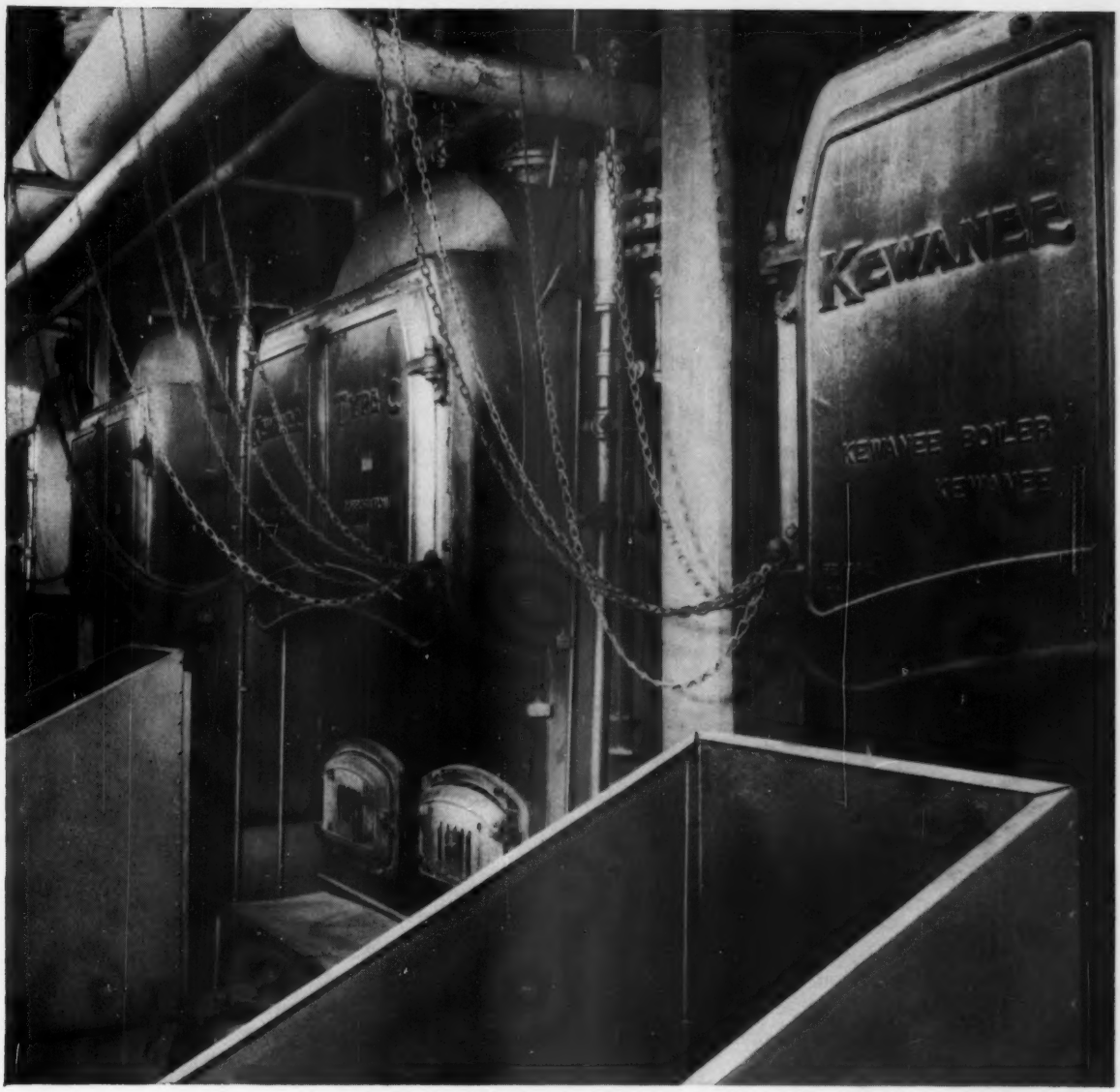
BITUMINOUS COAL INSTITUTE

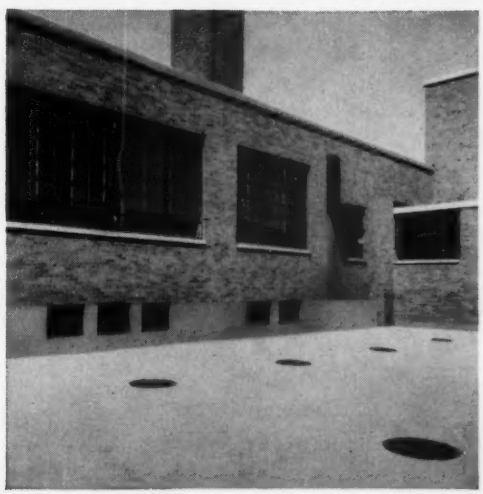
Department CE-04, Southern Building, Washington 5, D. C.

See our listing in Sweet's Files: A-30J/Bi; PE-4a/Bi; IC-18/Bi

Three boilers in foreground are Kewanee Type C firebox units, rated at 20,000 sq. ft. radiation, fired by Iron Fireman single-retort stokers, with 1000 lb/hr coal feeding capacity. At rear is Fitzgibbons Type D firebox unit rated at 29,000 sq. ft. fired by Iron Fireman stoker, 1200 lb/hr capacity.

Exterior view of power plant. Coal is gravity fed from trucks through manholes into 600-ton storage bin. It is then moved by Hager screw conveyor to stokers. Ashes move from ash room by Webster bucket conveyor to chute (on right) for disposal.





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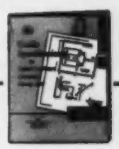
Guide Specifications, with complete equipment criteria and boiler room plans:



CE-04

Bituminous Coal Institute
Southern Building, Washington 5, D. C.

Gentlemen: Please send me:

- ☐ GS-1 (low-pressure heating plant, screw-type underfeed stoker).
- ☐ GS-2 (high-pressure heating and/or process plant, ram-type underfeed stoker).
- ☐ GS-3 (automatic package boiler for heating and process plants).
- ☐ Case histories on larger plants.

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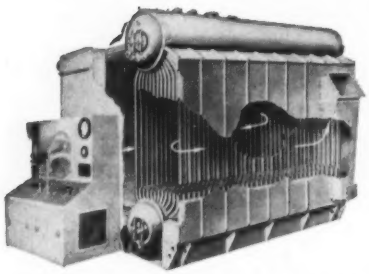
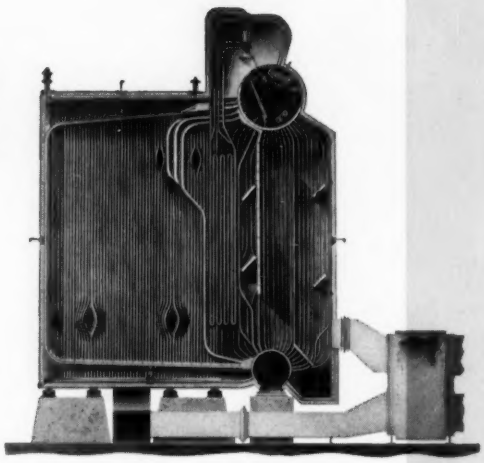
OIL AND GAS FIRED BOILERS
(standardized designs)



C-E Shop Assembled Boiler, Type VP—Available in 23 sizes ranging from 4000 to 90,000 lb of steam per hr capacity . . . pressures to 700 psi. Available with integral console control panel. This unit contains more water-cooled area per cubic foot of furnace volume than any other boiler of its size and type.



C-E Vertical-Unit Boiler, Type VU-55—Available in five sizes . . . capacities from 70,000 to 150,000 lb of steam per hr . . . designed for three pressures 250, 500 and 700 psi, and total steam temperatures up to 800 F. Equipped with tangential burners, 60-inch steam drum. Tangent tube waterwalls offer complete furnace protection, minimizing maintenance.

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Advanced designs for any fuel, firing or capacity needs

All the designs pictured here have something in common. All are evolved from a basic design concept – a 2-drum, vertical boiler with fully water-cooled furnace in front of the boiler proper – a design which Combustion Engineering originated more than 30 years ago and which has enjoyed the widest acceptance.

All are fully integrated designs comprising boiler, furnace, fuel-burning and, where required, superheat and heat-recovery equipment, coordinated into a smoothly functioning unit.

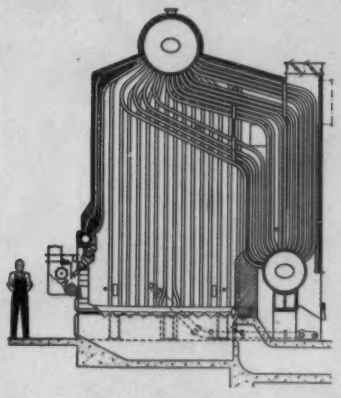
All have benefited from C-E's experience in meeting the most exacting standards in steam generation—the standards of the electric utility industry for which C-E has designed and built many of the boilers which are regarded as milestones in the industry's progress toward ever higher efficiency and economy.

All have demonstrated – in many installations – high standards of performance . . . economy, reliability and suitability for the particular fuel and operating conditions for which they were selected.

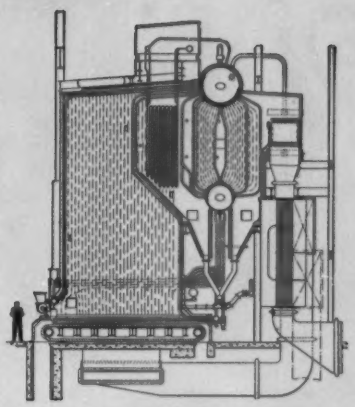
So – no matter what combination of conditions prevail at your plant, Combustion Engineering has a boiler unit that can meet your requirement, exactly – and economically. We'd like to discuss it with you and your consultants at your convenience.

ALL TYPES OF STEAM GENERATING, FUEL BURNING AND RELATED EQUIPMENT; NUCLEAR REACTORS;

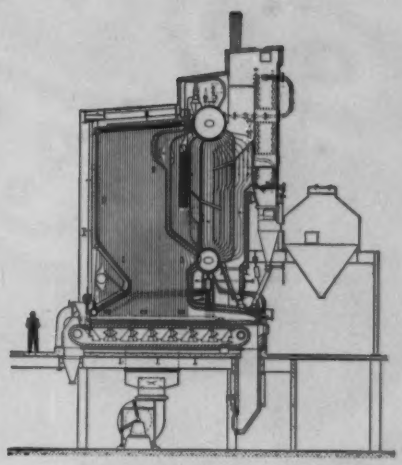
STOKER FIRED BOILERS



C-E Vertical-Unit Boiler, Type VU-10 — fired by a Spreader Stoker. VU-10 Boilers are available for capacities from 10,000 to 60,000 lb of steam per hr with pressures to 475 psi; superheat to 150 F. Can be equipped with Underfeed or Traveling Grate Stokers if desired.

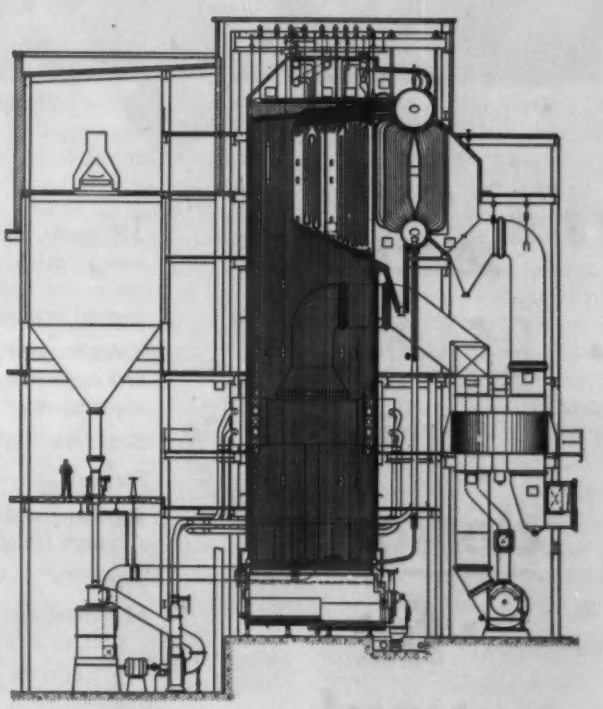


C-E Vertical-Unit Boiler, Type VU-40 — fired by Spreader Stoker, continuous discharge type — A baffleless boiler with capacities ranging up to about 300,000 lb of steam per hr, with pressures to 1,200 psi; temperatures to 950 F.



C-E Vertical-Unit Boiler, Type VU-50 — fired by Traveling Grate Stoker — Units of this design are suitable for capacities up to about 150,000 lb of steam per hr; pressures to 1,200 psi; temperatures to 950 F.

BOILERS



PULVERIZED COAL FIRED BOILERS

C-E Vertical-Unit Boiler, Type VU-40 — using C-E Raymond Bowl Mills and tilting, tangential burners — capacities up to about 600,000 lb of steam per hr, pressures to 1,200 psi, temperatures to 950 F.

Note: The drawings on this page are a few examples of the many units available for coal firing: all are readily adaptable to oil or gas firing.

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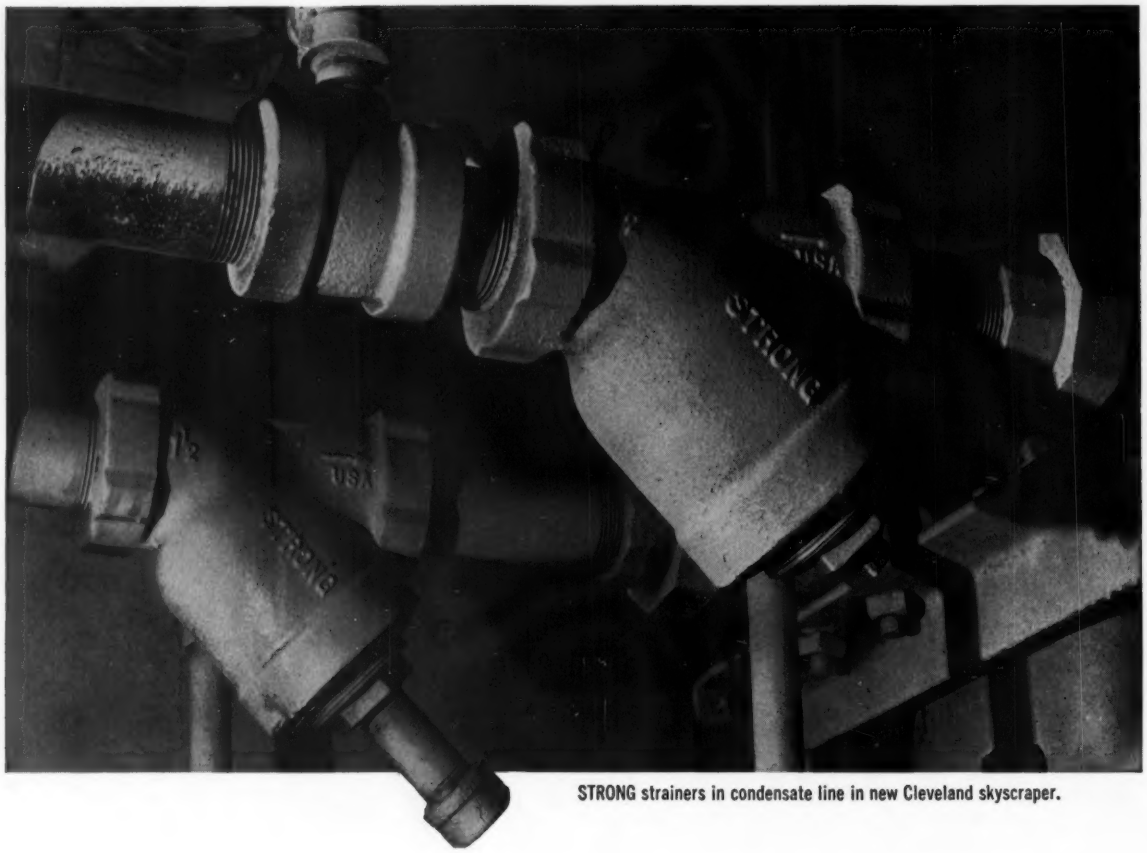

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Lee's Lecture

Rationalizing Consultation By College Professors

JOHN F. LEE
Broughton Professor and Head
Department of Mechanical Engineering
North Carolina State College

THE ETHICAL propriety of engineering faculties in rendering consulting services has been accepted for a long time — by the academic world, at least. This facet of academic life has expanded greatly since the last war, and it has become a matter of increasingly serious concern to both the universities and private consultants. Much has been said about the special position of the professor in the consulting field but no clear picture emerges. It is true, however, that in some instances consulting work has been done by professors under conditions detrimental to his university and to the profession.

It is argued that a professor in a professional school must practice his profession if his effectiveness as a teacher is to be maintained. The maintenance of an ivory tower in a professional school is intolerable and eventually leads to an improper preparation of students for the practice of the profession. The real questions are the extent and nature of consulting services performed by professors and the conditions which should govern their work. These questions are further complicated by the service functions of state universities and the growing economic pressures on professors to supplement their academic income.

Support Varies

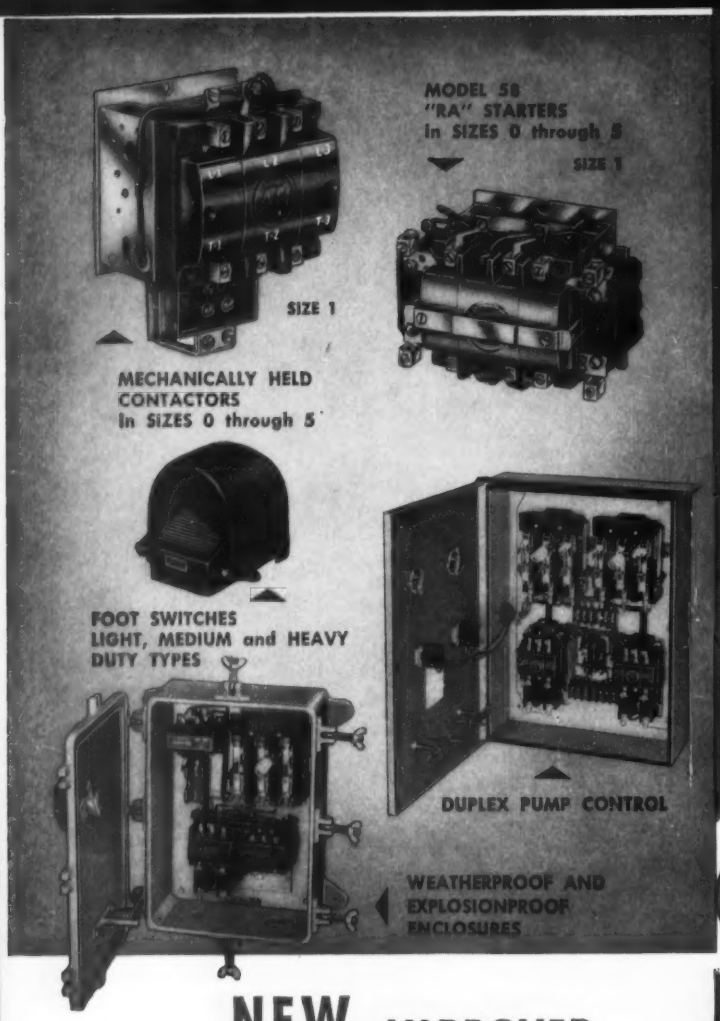
Traditionally, state universities (and land-grant colleges, in particular) have assumed responsibilities of service to agriculture and industry in their states. The agricultural extension services rendered by state universities are a commonplace in American rural life. The engineering experiment station, the counterpart for industrial service, is less well known because its scope always has been restricted as compared with agricultural services.

This difference between the two services is a matter of financial support, the philosophy for which goes back to the agricultural era when most of these universities were founded as agricultural and mechanical arts colleges. Those opposed to Federal aid to higher education have been shocked by the discovery that huge appropriations are made annually by Washington in support of agricultural services in land-grant colleges. They also may be shocked (or pleased) to find that virtually no funds are appropriated by Washington to support industrial services of a similar nature in our colleges.

The engineering experiment station, with the possible exception of some funds for highway studies, derives its entire support from appropriations made by state legislatures and private sources. Usually these appropriations are meager, so professors in engineering schools of state universities must derive their salaries from the instructional budget and are engaged mainly for teaching. Yet, there is an unofficial feeling that these professors should be willing to assist industries in the state as an extracurricular activity. Since the agricultural services are free (supported by huge Federal and state appropriations) the public often expects the consulting service of engineering professors in state schools to be free or nearly free, too.

Introduces Fee Problem

Thus, a tradition of fee-cutting is built into many state universities, and both the professor and the profession are victims. There also appears to be a natural correlation between inferior schools of engineering and the presence of docile faculty members who are willing



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to do a variety of odd jobs at cut rates. Hence, where engineering faculties are competing with private consultants at unethically low fees, the educational programs suffer. Inferior teachers tend to gravitate to those institutions. Salaries are notoriously bad which provides additional incentive to seek outside income. A vicious circle is established that can be broken only by courageous administrative action.

The professors in private universities are not completely innocent. In some instances community relations and efforts to please college supporters — coupled with low salary scales — bring about the conditions that consulting engineers feel are competitively unfair. In one small college struggling to maintain a third-rate school of engineering, a mediocre faculty is maintained through an agreement with a local benefactor to employ faculty members as production workers on a part-time basis.

What the Situation Should Be

Supplementation of income should never be the incentive for academic people engaging in consulting work. Instead, engineering consultation for professors should be restricted to projects for which they have eminent qualifications. The assignment should not be of a routine nature but should be within the area of the professor's special academic competence. This type of consulting practice enhances the professor's skill as a teacher and permits him to serve an appropriate role in the general field of consultation. In fact, a professor who engages in this type of consultation is a valuable resource for consultants engaged in general practice, and he should, where possible, be a consultant to engineers in private practice rather than to private or government clients.

Under no circumstances should a professor accept less than the prevailing fee in his region. Indeed, since his services are those

of a specialist his fees should be higher than those prevailing in general practice. If his services do not merit a fee at least as good as that normally paid to private consultants, the professor has no business consulting. Furthermore, he should not in any way be pressured into rendering free services to anyone unless that is part of his job and his university specifically pays him a salary to render those services. A professor who uses his protected position in a tax-exempt or tax-supported institution to compete unfairly with his professional colleagues should be severely censured by his engineering society.

Action Needed

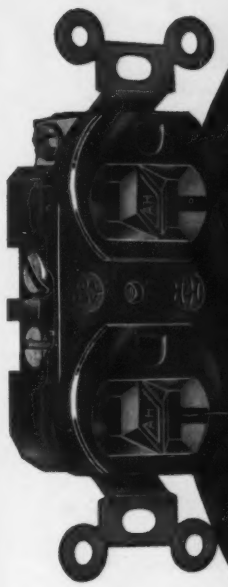
Better and more appropriate professional service on the part of engineering professors can be accomplished only through the active cooperation of university administrations and the engineering societies. Considering the responsibility of university administrations, it is clear that policies governing the character and conditions of professional practice by professors should be formulated and enforced. These policies should be developed with the close cooperation of the profession.

Consulting engineers, the acknowledged professional leaders, have been strangely quiet concerning the low pay scales prevailing in engineering institutions. Private practitioners have left engineering education to engineers in industry and to educators. Consulting engineers have failed to show much interest in the code of ethics and its application to engineering educators. They have neglected to take any responsibility in encouraging high standards for accreditation of schools of engineering.

We need to formulate clear objectives, define the means required to achieve these objectives, work closely with educators who are charged with the education of future engineers, and be daring in imposing high standards. ▲▲

ARROW AH HART

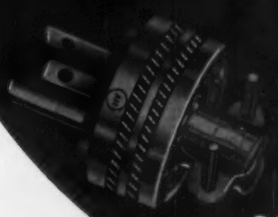
NEW 20 AMP GROUNDING DEVICES by ARROW-HART



3-WIRE
2-WIRE
20 AMPS
125 VOLTS

GROUNDING CAPS and RECEPTACLES

RECEPTACLE 5722



CAP 5786

IMPORTANT TO YOU UNDER THE NEW CODE REVISIONS

The 1959 revisions of the National Electrical Code extend grounding requirements to many additional types of industrial installations including: heavy-duty portable tools; scrubbing, cleaning and other maintenance equipment; business machines; and all receptacles in cellars, garages, shipping docks, etc. As a result, these new 20 Amp Grounding Caps and Receptacles will be "must" items for dozens of wiring applications throughout your plant.

Also available in weatherproof type with and without padlock, these Duplex Receptacles feature 2-circuit break-off fins that allow optional wiring as two electrically separate outlets where heavy loads will be encountered. Caps are available in rubber and armor-over-rubber types.

Wherever the new code calls for grounding-type wiring devices to insure safe operation, specify Arrow-Hart and insure the finest. Write now for information.

Dept. CE, The Arrow-Hart & Hegeman Electric Co. 103 Hawthorn Street, Hartford 6, Connecticut.

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Quality since 1890

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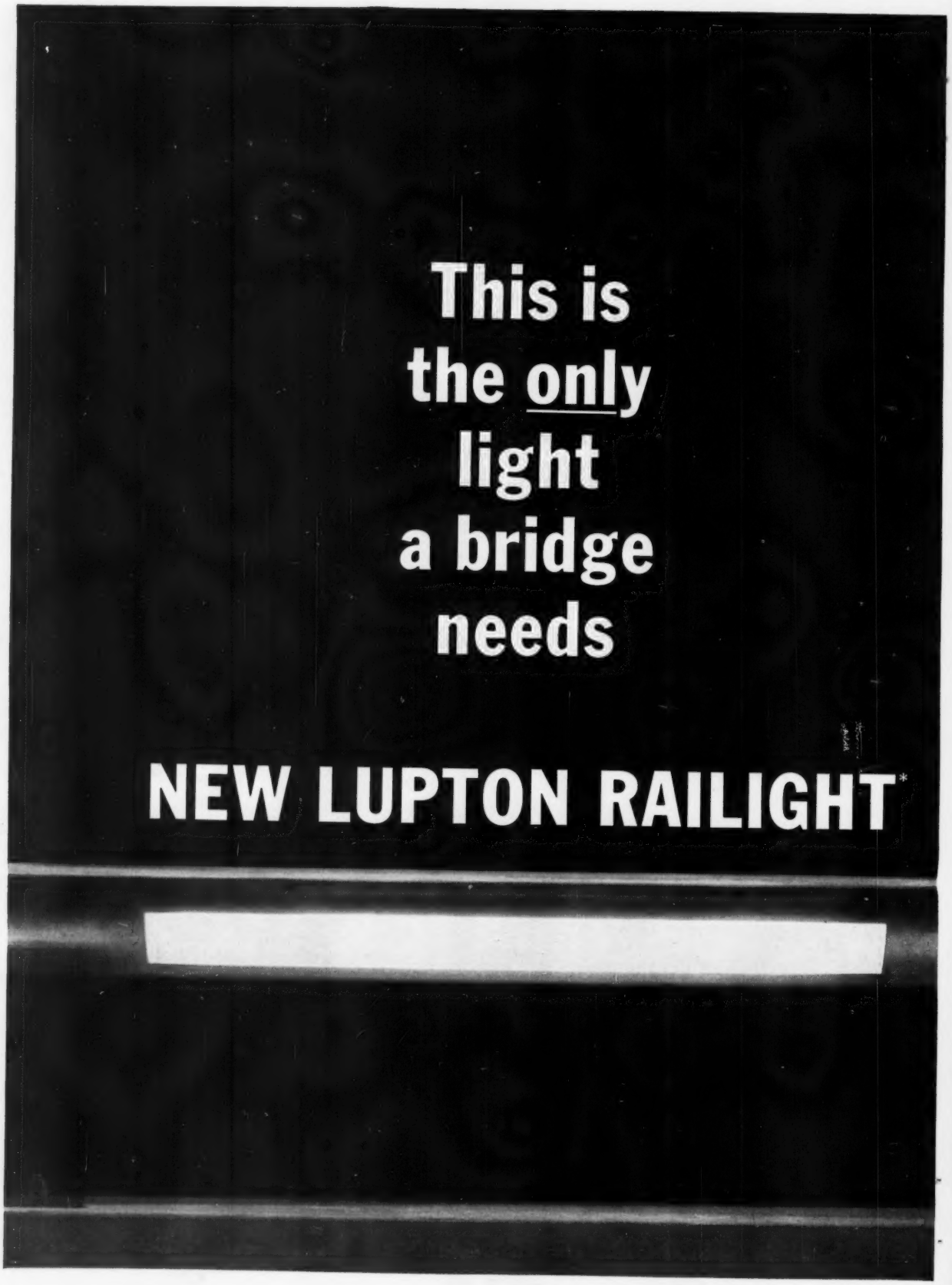
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a bridge
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New LUPTON bridge railing has built-in General Electric luminaires

New LUPTON RAILIGHT* is today's most advanced concept in roadway lighting. Now available in standard units for all roadway installations, it offers you these significant advantages: greater driving safety from uniform low-level light focused directly on the road; unlimited opportunity for road railing design; savings in initial cost, operation, and maintenance.

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And like every other LUPTON bridge job, installation is simple, because two men, with wrenches as their main tools, can install the lightweight aluminum parts. Maintenance is just as simple, because this non-rusting aluminum never needs painting—almost never needs replacement. And the lights themselves are handy for maintenance.

Write today to Michael Flynn Manufacturing Company's main office for more information on LUPTON RAILIGHT. Find out in detail how advantageously it can work for you.

Trademark

This cross section of LUPTON RAILIGHT shows the cable raceway, and how easily the top can be removed for maintenance with use of a simple special tool. A rigid shield of plastic protects the luminaire. Other top rail features include a reinforcing spine, and drain holes for condensed moisture.

LUPTON® RAILIGHT*

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West Coast Plant & Office:
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Building Research Institute Sets Goals for Better Buildings

ANYONE WHO has followed the attempts for many years to pull the engineering profession into a unified group can appreciate the problems faced by the Construction Industry Advisory Council of the U. S. Chamber of Commerce shortly after the end of World War II. All phases of the building industry were operating at full speed, and the Advisory Council thought some method should be found for getting the various segments pointed in the same direction.

Engineers never have succeeded in getting together as engineers, but the idea of the Advisory Council resulted in the Building Research Institute, an organization of engineers, architects, contractors, manufacturers of building materials, building owners, and teachers. Although it has had the usual growing pains, BRI now has conferences which draw as many as 900 building specialists from 50 states, Canada, England, South Africa, and Russia.

The Building Research Institute began when the U. S. Chamber of Commerce's Advisory Council took its problem to the National Academy of Sciences (which had been formed in 1863 under Lincoln to "investigate, examine, experiment, and report upon any subject of Science and Art") and the National Research Council, originally added to the Academy under executive order in 1918 "to promote research in mathematical, physical, and biological sciences, and in the application of these sciences to engineering, agriculture, medicine, and other useful arts." While set up as a branch of the Academy, the Research Council later was given equal billing.

The NAS-NRC approached the problem by selecting a Building Research Advisory Board (BRAB) of 20 to 30 men – all recognized leaders in industrial, governmental, or academic research and development. These men were instructed, upon their appointment in 1952, to direct their activities to answering the following questions:

(1) What are the recent developments in building research and technology?

(2) How do current research activities relate to each other for the solution of building problems?

(3) What are the research facilities of the building industry and its cooperating research agencies?

BRAB was to accomplish these major objectives through:

¶ Correlating by surveys of current research planning, activity, and results; and by organizing data into a comprehensive pattern.

¶ Stimulating new research by identifying new problems, by developing new ideas through conferences and forums, and by generating new activity through committee work.

¶ Furthering the knowledge and use of research by publishing information about current research, by reporting the proceedings of conferences, and by encouraging the trial and adoption of research.

¶ Guiding research into a more effective pattern by advisory services to government agencies, research organizations, and industry.

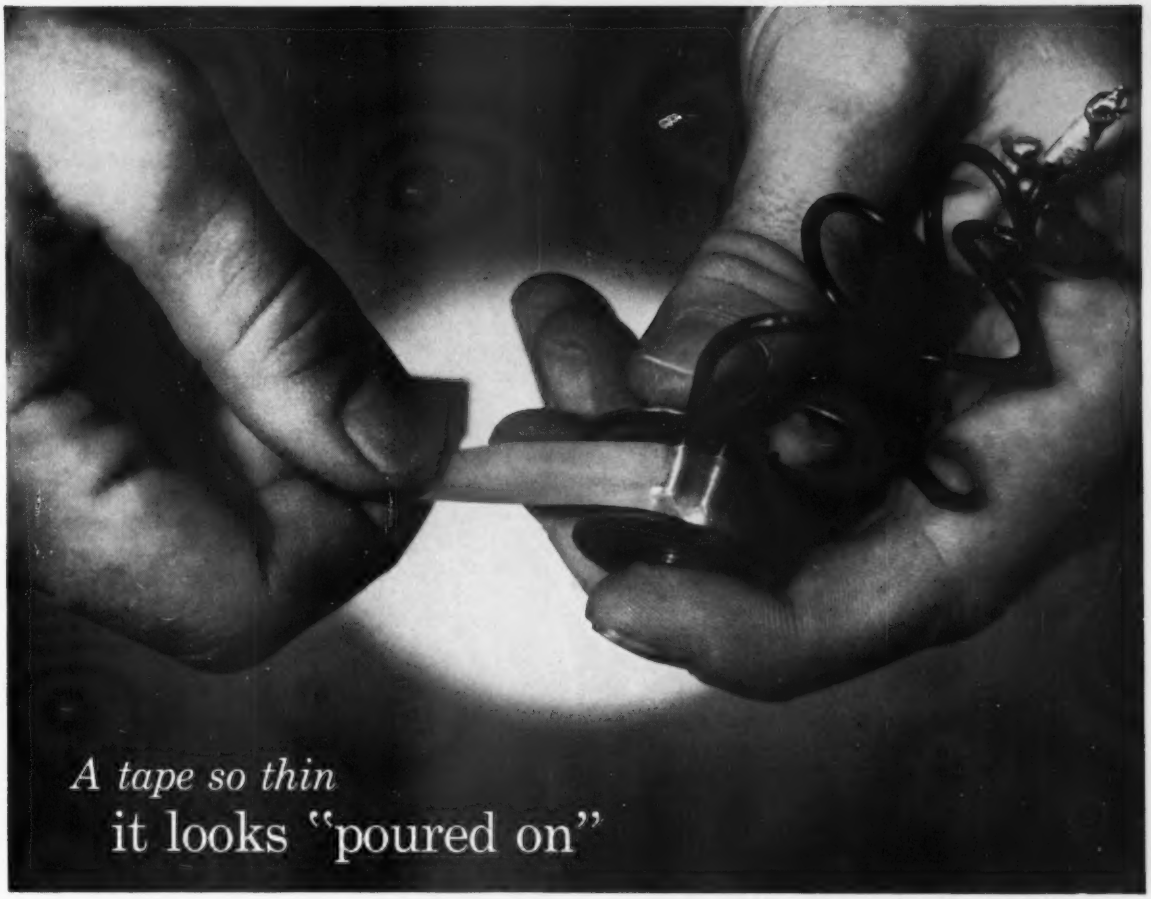
This was a large order, and it was discovered that no 20 to 30 men working alone could hope to have the broad contacts necessary to accomplish these objectives without help. Thus the Building Research Institute (BRI) was formed. This is the membership organization open to engineers, architects, contractors, and others in the building field. BRI was established not subservient to BRAB but to work on an equal basis, directly under the Division of Engineering and Industrial Research (now headed by Dr. Augustus B. Kinzel, president of Engineers Joint Council) of the NAS-NRC.

At first, BRAB and BRI worked together towards all of the original BRAB objectives, except that BRI never took an active part in the preparation of reports on a contract basis for the various governmental agencies.

Soon, BRI grew to the point that it was conducting the annual conferences and all once-shared activities alone, again with the exception of the government reports. BRAB still is a board of 20 to 30 experts working under contract toward the solution of any government-assigned problem. For instance, one of the current BRAB projects undertaken for the Federal Housing Administration is a nationwide study of soil fills for single and multistory residential properties.

BRI's growth proves that there was a need for liaison in research related to the building sciences. With carefully planned conferences and an extensive publications program, BRI has become an organization of 400 firms and more than 1200 individuals working together on a noncommercial basis to solve today's problems and to set tomorrow's goals for better buildings.

It has succeeded to the extent that it is able to schedule, without bloodshed, such topics as "Who is at fault when a curtain wall leaks?" At one time, such a question would have resulted in the engineer pointing to the architect who then would



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- *Extraordinary thinness and flexibility*
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Put a layer of J-M Dutch Brand Polyester Electrical Tape on a coil winding, and you'll see every turn of wire stand out, sharp and clear. The one-mil thickness and extra stretch of this unusual tape allow for maximum conformation to irregular surfaces with *minimum tape build-up.*

One of 15 brand-new tapes for the electrical "specialist," Johns-Manville Dutch Brand Polyester Tape is ideal for Class B insulation in electric motors. Its dielectric value is 4500 volts. It stays stable at operating temperatures up to 125°C . . . resists oil, grease, corrosive chemicals, solvents, punctures, tears, and moisture. Available with a thermosetting adhesive that won't throw out at high speeds, or with a pressure-sensitive adhesive that holds instantly and never becomes brittle.

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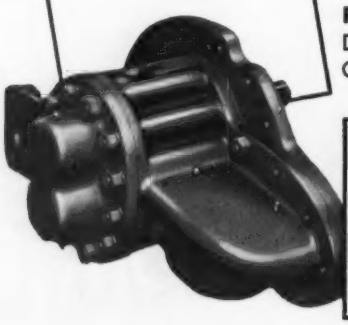


ROPER
ROTARY PUMPS

blame the contractor. From there the blame traveled to the adhesives manufacturer, to the glass manufacturer, and possibly back again to the engineer. Now, at least, everyone gets a broader understanding of the other person's problems.

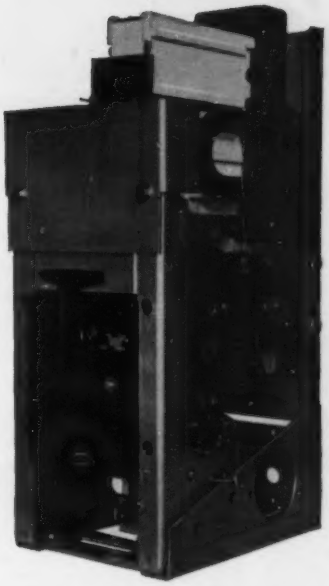
Backbone of BRI today is its multisubject conferences, held two times annually — spring and fall. A suggested topic, usually coming from one or more BRI members, is presented to the program committee, which decides if the subject is of sufficiently broad interest to merit a full conference or if it should be referred to the smaller workshop or round-table discussion groups. If selected as a conference topic, the subject then goes to a smaller committee responsible for getting the top brains in the country on the program. Speakers need not be BRI members, but they must be authorities in their field. The NAS-NRC also keeps a proprietary eye on program topics as an added check against possible commercialism.

Among the subjects covered at recent conferences have been New Methods for Heating Buildings; Sandwich Panel Design Criteria; Design Potential of Metal Curtain Walls; Building Illumination — the Effect of New Lighting Levels; and Noise Control in Buildings. These meetings were open to the public and to the press. All papers are bound and circulated to BRI members and to guests of the conference. They also are offered for sale to others through the National Academy of Sciences' Publications Office.

Any question as to the general importance of a suggested topic can be settled by a round-table group. These groups are informal gatherings of a few qualified people to explore the need for study of a particular subject.

A problem of importance but of limited general interest may be referred to a workshop, consisting of experts in a particular field, attend-

The d-c breaker you can buy today that won't be obsolete tomorrow



Stationary type single-pole FB breaker in 1200 amp rating with manual stored energy closing.

Actually this new-design model FB circuit breaker from I-T-E is somewhat of a phenomenon in its field. Of all breakers available for direct current, this is the only one that really makes use of today's modern materials and up-to-date knowledge of circuit breaker design. You might say it's the only modern d-c circuit breaker on the market today.

HIGH SPEED

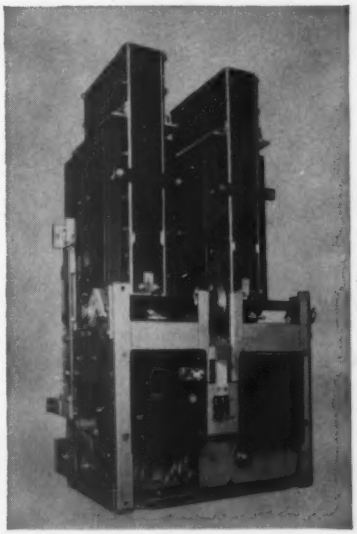
In today's high-capacity d-c circuits, you *need* a high-speed breaker. Otherwise you risk thermal or mechanical damage to equipment—such troubles as commutator flashover in rotating equipment or arc-back damage to your rectifiers. Many circuits today still have semi-high-speed breakers that don't give adequate protection. At the time they were installed they may have been the best available. Or else high-speed breakers were too expensive. That isn't true with the FB. Without paying a premium price, you get high-speed operation. Current limiting action occurs *within 6 milliseconds*. And the breaker may be safely applied to 1000 volt d-c circuits having a rate of rise of 15 million amperes per second. So the FB breaker can be used with confidence in practically all d-c circuits.

COMPACT SIZE AND LIGHT WEIGHT

Probably the most obvious difference between the new FB breaker and some of the old-design models still being sold is the greater compactness. This is one of the direct results of modern materials and technology. I-T-E engineers have given you actually superior circuit protection in less space. And the use of modern materials has shaved off many pounds of weight. Because of this they are now available in general-purpose enclosures. In addition, such new-design details as tilting arc chutes, elimination of flexible connectors, and exclusive drawout construction make this the easiest-to-maintain d-c circuit breaker you ever saw.

AVAILABLE IN 1 OR 2 POLES

If you are operating a single-wire grounded system, a single-pole circuit breaker arrangement will suffice. But suppose you are operating a 2-wire, ungrounded system. Then a 2-pole circuit breaker is desirable. And only the I-T-E model FB offers it. This is real 2-pole construction, with both poles fully integrated mechanically and electrically for simultaneous opening and closing under all conditions.



Drawout type 2-pole breaker in 6000 amp rating, electrically operated.

REALLY FUNCTIONAL MECHANICAL ADVANCES

Who but I-T-E would be first to give you an advance such as manual stored energy closing in a d-c circuit breaker? No slow burning of contacts with the FB. It closes in roughly 1/12 to 1/6 second for greater safety and longer contact life. You have your choice of either manual or electrical closing. The motor-operated closing mechanism draws only 5 amperes—a great advantage over the usual 50 amperes required by solenoids. Precision construction typical of I-T-E equipment, coupled with drawout design, permits complete interchangeability of breakers and parts in breakers of equal rating.

REPLACE NOW

There's questionable economy in trying to stretch out the life of old equipment that can mean costly downtime and inadequate protection. The wiser move is to replace now with new-design model FB breakers that are far ahead of the field. Models in capacities from 1200 through 12,000 amperes continuous and 1000 volts d-c. Write for the new detailed and illustrated Bulletin 4601-1A. I-T-E Circuit Breaker Company, Dept. SW, 1900 Hamilton St., Philadelphia 30, Pa.

I-T-E CIRCUIT BREAKER COMPANY

ing by invitation. In addition, study groups are formed for BRI members who want to concentrate on developments in a particular area. These meet as often as members desire. Attendance is limited to BRI members and their guests.

Reports of study groups and workshops also are published in booklet form, sent free on request to all BRI members and to those who have attended meetings. Others can purchase them.

Among the most important BRI publications is a Building Sciences Directory, a guide to building research in all branches of the industry. Supplements are issued quarterly. The Directory has attracted the attention of Canadian and British groups interested in compiling a similar publication for use in their countries.

BRI also offers abstracts; quarterly reviews of books, periodicals, and research reports; and a monthly newsletter. A register of members is circulated annually to members.

The organization offers an opportunity for consulting engineers to gain perspective through acquaintance with experts in building fields other than their own. Conferences, workshops, and forums offer an opportunity to express opinions where they can be of value. And above all, BRI helps the engineer keep abreast of a rapidly changing field.

Dues for consulting firms are set on a sliding scale based on the annual dollar volume of construction designed. Range is from $50 to $200 per year.

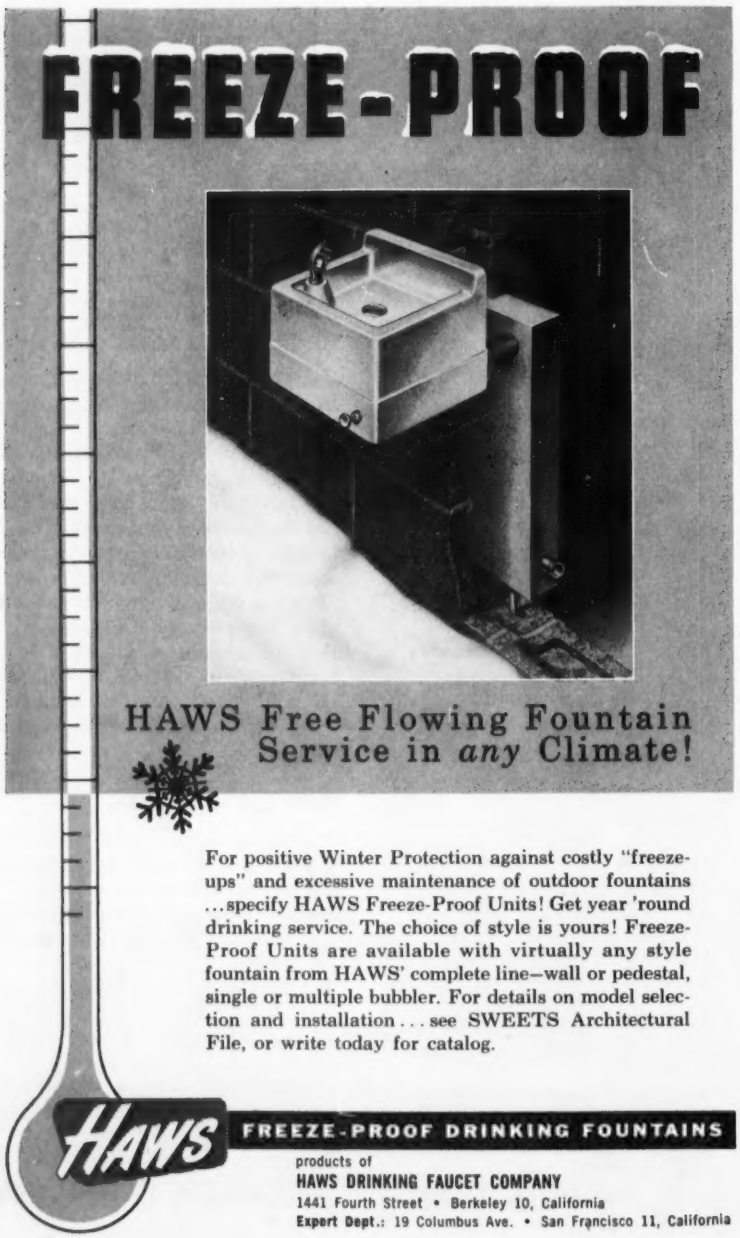
The next BRI conference will be held in a few days (April 5 through 7) at the Statler-Hilton in New York City. Among the speakers will be Arthur J. Hess, consulting engineer and immediate past president of the American Society of Heating, Refrigerating, and Air-Conditioning Engineers, who will discuss "What is Pure Air?" This will be part of a full-day program on air cleaning and purification.

Ralph Walker, of Voorhees, Walker, Smith, Smith, and Haines, will talk on "Performance Information Needed by the Architect," in a conference-workshop on "Performance of Buildings."

Four years ago, BRI held a conference on Modern Masonry. At the April meeting, subsequent progress in design methods for insulated masonry cavity walls will be discussed.

Among the other topics will be the use of adhesives for laminated structural timber beams, for drywall construction, and for bonding cementitious materials. A roundup also will be given of current college and university research programs in the building field, and proposals for new building research by colleges and universities.

Nonmembers may attend BRI meetings, but must pay a higher registration fee than is charged to members. ▲▲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HAWS Free Flowing Fountain Service in *any* Climate!
For positive Winter Protection against costly "freeze-ups" and excessive maintenance of outdoor fountains ...specify HAWS Freeze-Proof Units! Get year 'round drinking service. The choice of style is yours! Freeze-Proof Units are available with virtually any style fountain from HAWS' complete line—wall or pedestal, single or multiple bubbler. For details on model selection and installation ... see SWEETS Architectural File, or write today for catalog.
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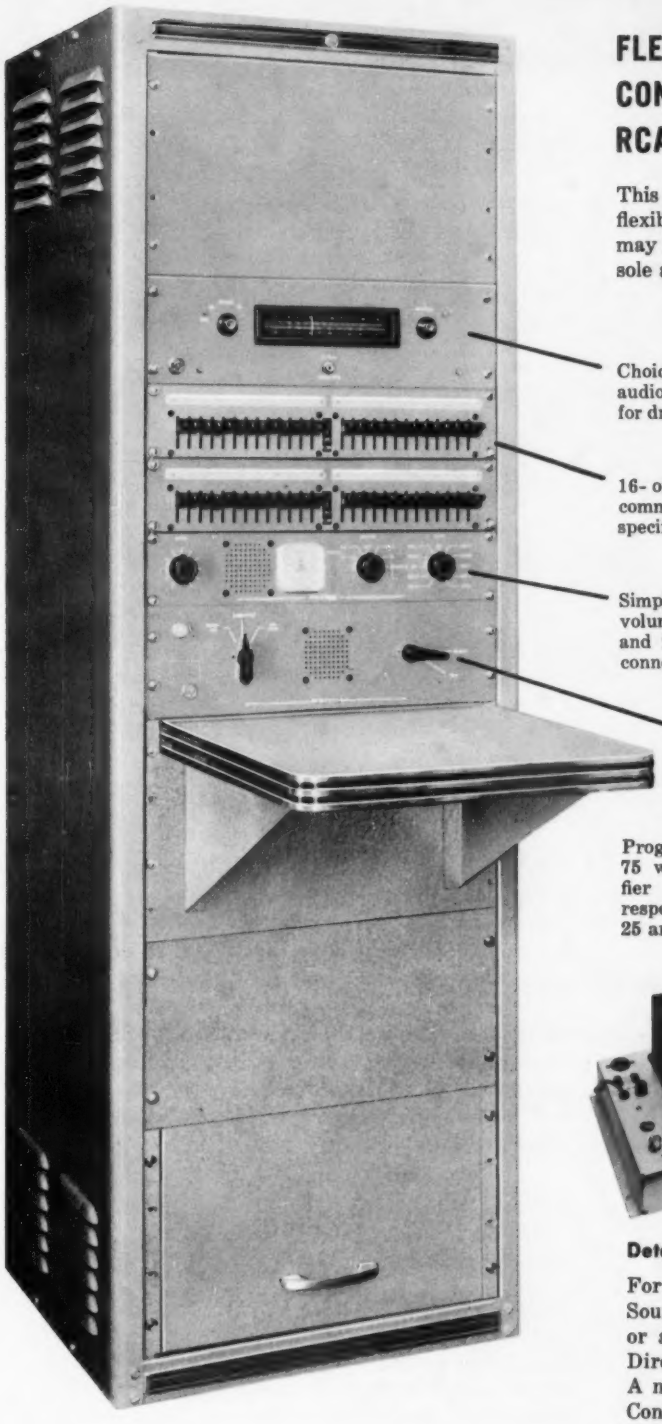


FLEXIBILITY AND OPERATING CONVENIENCE KEY FEATURES OF RCA MODULAR SOUND SYSTEMS

This rack mounted RCA Sound System illustrates the flexibility and convenience of modular design. Elements may be varied in location in this rack or in the desk, console and turret cabinets also available.

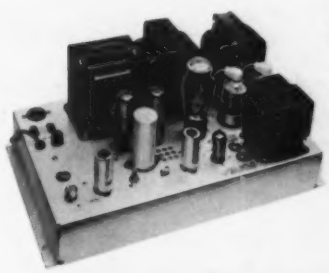
Choice of standard or deluxe AM-FM Tuner . . . extended audio-frequency range . . . extreme sensitivity . . . AFC position for drift-free reception.

16- or 26-key switchbank panels for controlling program and communication available. As many panels as needed can be specified. Optional light annunciators.

Simplified program panel contains only three control knobs: volume control, monitor selector switch to control distribution and input selector. All cabling terminates in plugs for easy connection.

Intercom panel includes a talk-listen switch and one for intercom — all-call selection. Monitor microphone built into the panel—separate mike not required.

Program amplifiers 35 or 75 watts; intercom amplifier 10 watts. Frequency response 20-20,000 cycles; 25 and 70 volt output tapes.



Automatic 4-speed changer plays up to 12" records at 78, 45, 33⅓ and 16 rpm. Intermixes 10" and 12" records . . . oversized 4 pole, 3-coil motor provides hum-free operation at all speeds. Manual turntable also available.

Detailed Information Available at Your Request

For information and specifications on New Modular Sound Systems and their assemblies, write to RCA or ask your Sound Distributor. He's in the classified Directory under "Public Address and Sound Systems". A new booklet, Select-a-Guide on RCA Modular Sound Control Systems, pictures and describes this flexible central sound equipment. Request Form 3J3668.

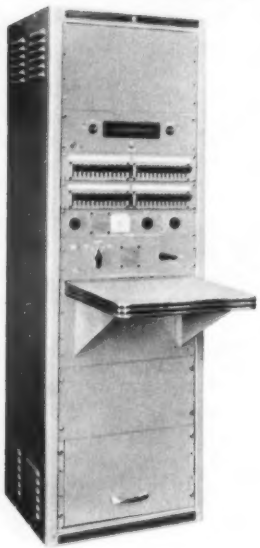
RCA Tmk(s) ®

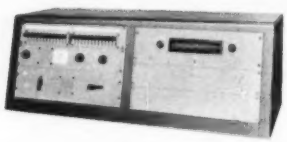
RADIO CORPORATION of AMERICA

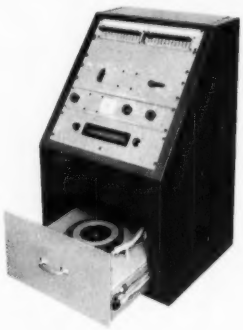
AUDIO PRODUCTS CAMDEN 2, NEW JERSEY

AUDIO NEWS
for consulting engineers

RCA SOUND SYSTEMS NOW MADE TO ORDER FROM PREWIRED PLUG-IN ASSEMBLIES







New Modular RCA Sound Controls use standard panels mounted in a variety of cabinets.

RCA's new modular sound control systems are of significant importance to consulting engineers and clients because they *permit quick selection of assemblies to meet exact requirements*, are *unusually simple to operate*, and *provide greater reliability at lower cost.*

These new "building block" systems from RCA are based on the four basic cabinets illustrated and a wide selection of standard assemblies which can be installed in many combinations—affording a high degree of flexibility.

Flexibility of Design

RCA's Modular Sound Control System assemblies are mounted on 19 inch panels and stocked as standard units.

Planning and specifying an RCA system is greatly simplified—merely requires determining the functions to be accomplished by the sound system and selecting the standard assemblies and cabinet which best match the requirements. The specified elements are prewired with plug-in connections; are custom assembled by factory experts, and shipped ready for installation. Once one of these flexible systems is installed, the modular-construction concept makes later expansion easy. Service, too, and parts replacement become greatly simplified.

Simple to Operate

Simple operation combined with flexibility are characteristic of RCA's modular design. The number of operating controls, switches and knobs have been reduced to essentials without detracting in any way from the functions of the system. The program panel, for example, has only three controls. The intercom panel is equally simple and incorporates a combination monitor-loudspeaker and microphone. It also features RCA's single "ALL-CALL" switch that instantly connects all loudspeaker locations for emergency announcements.

Easy to Install and Maintain

Reliable performance at lower cost is an inherent advantage of these new systems. Installation is readily accomplished, since the systems are shipped with all units mounted in place. Before leavingthe factory, the individual assemblies are tested and the entire system is checked out to meet RCA's rigid quality standards. Components are readily accessible for service and parts replacement.

Assemblies for RCA Modular Sound Systems are illustrated and briefly described on the next page.

The revolution in dictation starts with Stenorette
Stenorette
Fully Transistorized Stenorette-T with either dictating or transcribing accessories—only $199.50 plus fet

Now—an electronic eraser under your thumb

Full microphone control on this Stenorette makes your dictation faster, error-free!

End costly, time-consuming dictation!

Just *one* button on your Stenorette microphone lets you dictate, backspace, review. And, if you say it wrong, erase as you say it again *right!* No embarrassing mistakes. No frantic fingering.

Magnetic tape does it. Stenorette—fully transistorized for instant operation—is the only machine to use clear, easily-corrected, re-usable tape *properly*. Your dictation is error-free—the easiest, fastest you've ever known.

Your secretary transcribes faster too. Because she doesn't have to pre-listen for errors, she types it right the first time. Automatic Voice Control gives her uniform playback at all times. No wonder she's happy to say goodbye to outdated discs, cylinders and belts!

No other machine compares in cost, quality or features. Just imagine what your company can save with Stenorette tape alone! And a Stenorette system—coordinated for dictating *and* transcribing with desk-models in your office, portables in the field—costs about half that of other systems.

Ask for a revealing 15-minute demonstration in your own office . . . to learn all the amazing facts about *the revolution in dictation that starts with a Stenorette.*

Stenorette® COMPANION. Fully transistorized, portable, powered by lifelong rechargeable battery. 45 min. reel. Compatible with desk-model Stenorette. Only $199.50 plus fet

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Send booklet describing the revolution in dictation ☐
Have your representative call for a demonstration ☐

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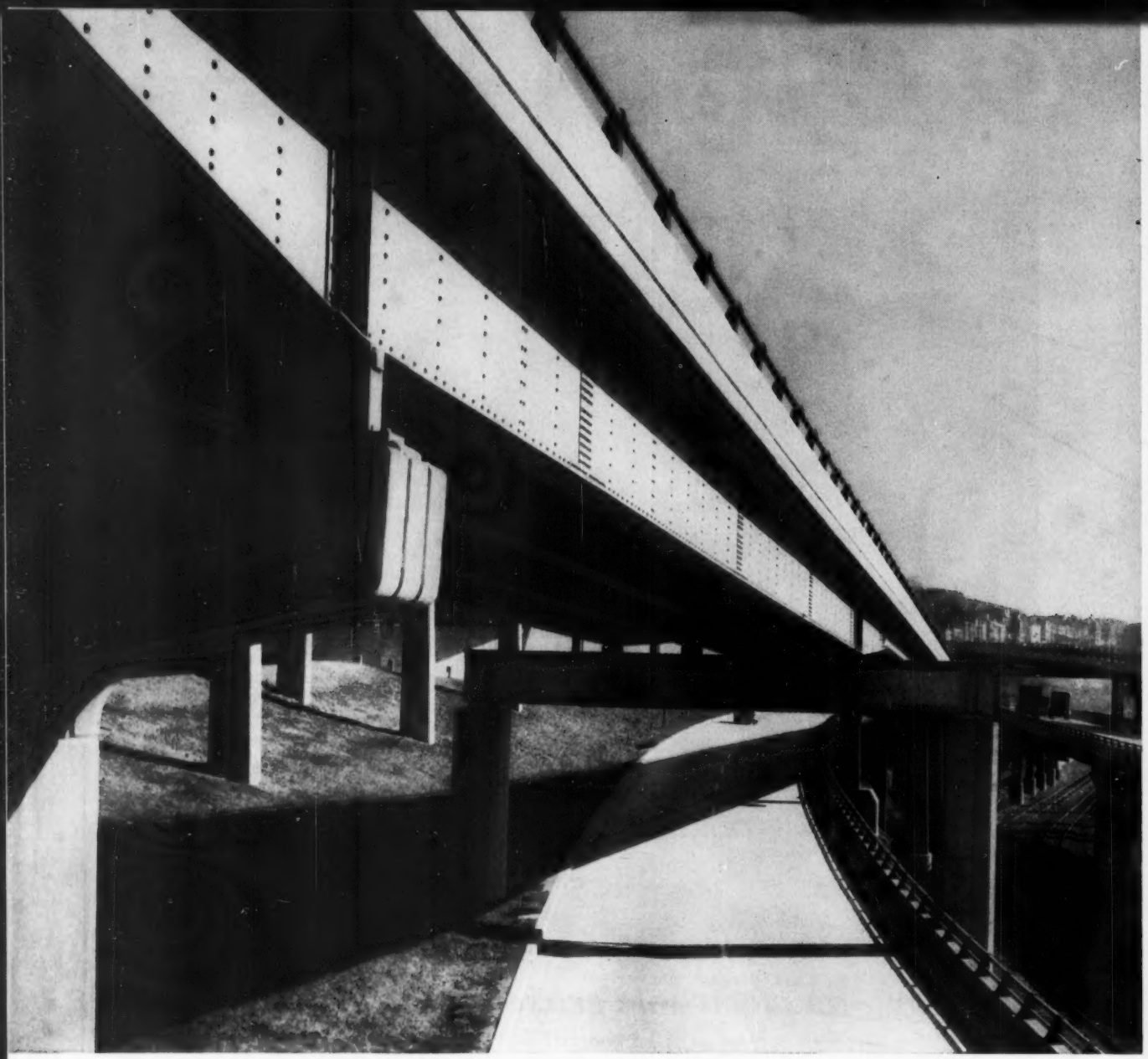
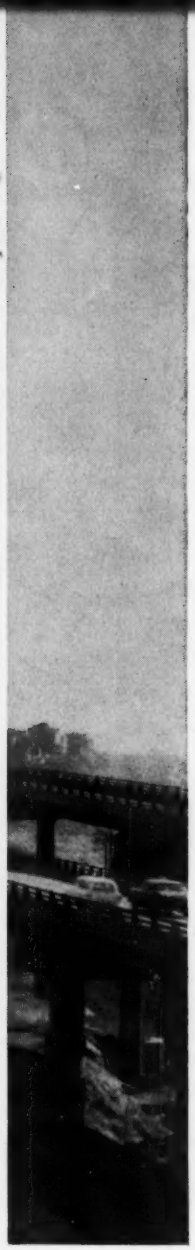
3 Address_____
9 City_____ Zone____ State_____



Steel members provide better clearance, faster construction on Brady Street Interchange.

Brady Street Interchange, Pittsburgh, Pa., part of the $100 million highway job, carries the Penn Lincoln Parkway and U. S. Routes 30 and 22.

Keep our roads on the GO



Steel is used for 80% of the bridges

designed by Richardson, Gordon and Associates, Pittsburgh, Pennsylvania

By using steel for the nine structures comprising the complex Brady Street Interchange in downtown Pittsburgh, Richardson, Gordon and Associates avoided extra engineering costs, kept traffic tie-ups to a minimum, and held grades within practical limits. The hilly terrain in Pittsburgh imposes severe restrictions on the designer. Steel saved valuable inches of clearance, and every inch saved meant improved interchange layout.

The firm of Richardson, Gordon and Associates has had a major role in engineering such impressive projects as the $50 million section of the Indiana Toll Road, involving the Gary-West Interchange near the Chicago city line; relocation studies of the $38 million Interstate project from the California line to Reno, Nevada, and design of a part of it; and $100 million worth of highway relocation and new expressway construction in the Pittsburgh area.

Mr. Richardson says that they enjoy designing with steel . . . it's a versatile working material, and they know exactly what its performance will be. More than 80% of their bridge designs employ steel throughout. Steel can be transported rapidly and in great quantities when long distances are involved. Since all projects are handled on a time schedule, this feature alone could mean the difference between profit and loss on a given job. Then, too, steel is not difficult to handle, when being transported or placed in a structure.

Increased facilities. Because of the vigorous, ever-expanding demand for steel structures, United States Steel has greatly expanded its facilities for the manufacture of structural shapes and plates. You can confidently design in steel—the material that offers most—knowing that steel will meet your needs and be available. *USS is a registered trademark*

Mr. George S. Richardson, Senior Partner of Richardson, Gordon and Associates and Mr. James H. Morehouse, Partner, examine scale model of Brady Street Interchange, Pittsburgh. In the background is photo of the Delaware River Turnpike Bridge which won Honorable Mention—Class I in the 1956 Annual Bridge Competition of the Institute of Steel Construction.

USS

United States Steel Corporation—Pittsburgh
Columbia-Geneva Steel—San Francisco
Tennessee Coal & Iron—Fairfield, Alabama
United States Steel Supply—Steel Service Centers
United States Steel Export Company

United States Steel

"Quote . . . End Quote"

Britain Appreciates Consultants

"I am very glad to have this opportunity of paying public tribute to the very important part played by the British consulting engineer both in the development of the backward countries of the world and as a spearhead for engineering and other exports. The importance of this role is sufficiently shown by the value of the overseas contracts for which your members are responsible. In January last year this reached the very large total of $1.76 billion, itself an increase of $224 million over the previous year. I do not think many people outside your association have any idea just how large this figure really is.

"Among the many projects included in this great figure perhaps I might mention the Hong Kong water scheme, estimated at $56 million; the East Pakistan irrigation and hydroelectric scheme, valued at $70 million; the Escravos Training Moles in Nigeria; the Accra sewerage scheme; and the new Baghdad International Airport. In addition, I understand that one of your members has just started work on a most interesting design for an island oil tanker terminal to be constructed in the Persian Gulf in 70 ft depth of water.

"These great constructional works are, of course, a major contribution to the task of raising the standard of living in the underdeveloped parts of the world. But they are also of great significance for the future of export trade and thereby for the economic prosperity of our country. Every project designed or built by British engineers enhances the prestige of our technical skill, and creates a favorable climate for our exports of capital and other goods, as well as earning international goodwill.

"I would like to give one instance of this: the Prime Minister recently received a letter of congratulation from the Prime Minister of Turkey on the admirable way in which British firms had completed a great hydroelectric project there." — F. J. Erroll, *Minister of State of the Board of Trade* at annual dinner of Britain's Association of Consulting Engineers.

Management Consultants

"Today, there is hardly a problem in management on which some consultant can't be of help. If you're swamped and sinking in a morass of paperwork, a certain consulting firm with offices in New York, Chicago, and San Francisco can bail you out and drain your files of useless memorandums. If you need help with problems of marketing, quality control, public relations, production, employee-employer relations, development of new business, or simply want to know how to run a plant cafeteria, you can easily find a consultant who will come to your aid.

"While the consulting profession's services are varied, so are the relations its members maintain with clients. They range from calm, conservative, doctor-to-patient attitudes found in the upper echelons down to promoter's tactics sometimes encountered in the lower and, fortunately, less populated ranks.

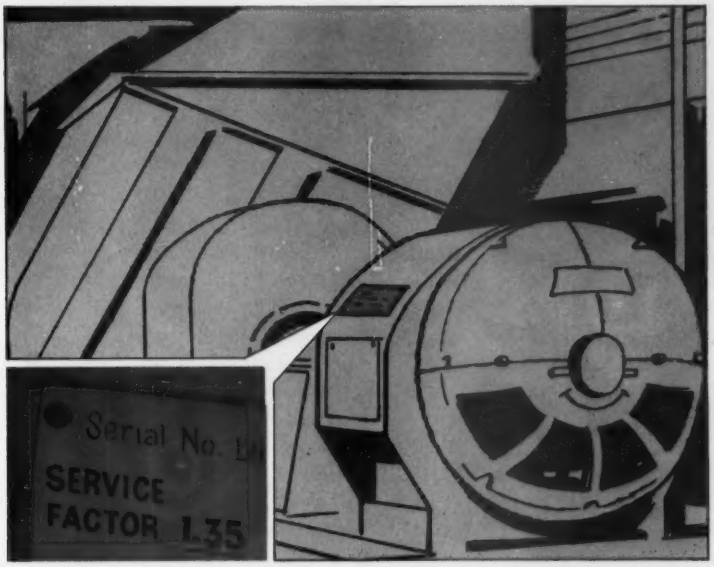
"At the top are the large, well-established partnerships with branch offices in many of the old business centers of America, and, in some cases, abroad. Many of them, though not all, are members of ACME (Association of Consulting Management Engineers, Inc.), the only association of its kind in North America.

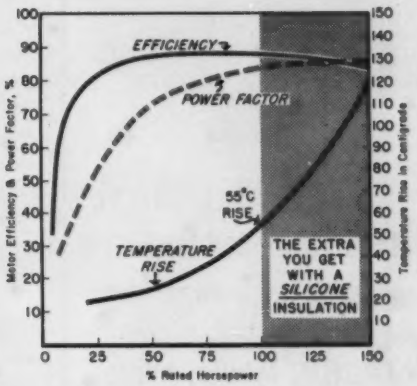
"ACME is dedicated to the idea that management consulting is and should be a professional field of endeavor, comparable, for example, to medicine and law. The association insists that its 40 members honor a code of ethics consisting of 16 printed articles. This code, for instance, frowns upon any advertising that presents a consulting firm, its practices, or merits in a self-laudatory manner 'or in any other way which gives the impression of being undignified or unprofessional.'

"But despite its efforts to build up professionalism in an established business, ACME faces a

SILICONE NEWS from Dow Corning

Economy vs Reliability?





You Get Both When You Specify High Service Factor Motors for Auxiliary Drives

Motors built to entirely new design concepts are now available from leading manufacturers! They *look* like other motors. But they differ radically in performance . . . they'll carry overloads of fifteen to fifty percent *above* nameplate horsepower rating. They're insulated with Dow Corning Silicones for increased service factor!

THIS INCREASED SERVICE FACTOR:

1. ***Simplifies Motor Specifications.*** With increased service factor motors, you can match nameplate horsepower ratings to nominal loads . . . these motors are well-equipped to handle temporary, or even continuous overloads. Generally, there's no need to calculate maximum loads. All the safety factor that motors normally need . . . even for fan and pump loads . . . is already built-in!

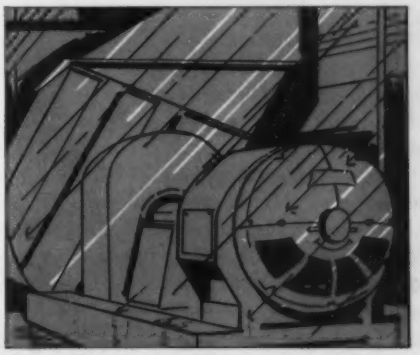
2. ***Reduces the Cost of Horsepower.*** With motors rated to average loads, the total installed horsepower is substantially less . . . and it costs less! If accepted application engineering practices are followed, additional savings result from lowered transformer and switchgear requirements . . . motor mounts and accessories cost less . . . and motors are easier to install.

3. ***Increases Reliability.*** In addition to increased service factor, thermally stable Dow Corning silicone insulation assures motor reliability in the high ambient areas near boilers, stacks, and high temperature processing equipment.

For more information on what silicone insulated service factor motors can mean to you, write Dept. 1004.

How do manufacturers build so much extra into a motor? By substituting an insulation system made from Dow Corning Silicones for the Class A insulation systems used in standard lines. Only the insulation is changed. Frame, electrical steel and copper remain the same. And there's one change on the nameplate—*service factor rating goes up!*

On a TEFC motor, for example, service factor goes up from 1.00 with Class A insulation materials to somewhere between 1.15 and 1.50 when silicones are used.



Simplify Enclosures. You can also save by specifying silicone-insulated motors for outdoor service. The reason: "Self-protecting" insulation systems made with Silastic®, the Dow Corning silicone rubber, require no premium priced enclosures. You can specify open frames. No need to protect the insulation against outdoor elements.

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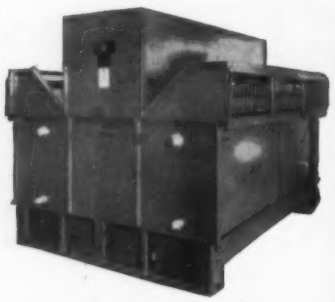

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- **Because you save 95% of cooling water cost.**

You get faster, more accurate cooling of industrial fluids to specified temperatures.

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First cost is low; freight is low because of the lowest space/weight ratio; you save much labor in erection. Capacity range is 7,000,000 to 18,000,000 Btu/hr. No other heat exchange method gives you so much saving in money and convenience.

Write for Niagara Bulletin No. 132

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problem that not even the most sagacious consultant can solve very quickly. This is the matter of the establishment of professional standards. Unlike the doctor and the lawyer, the management consultant's office wall lacks the framed 'sheepskin' certifying that he is educationally qualified to be what he claims to be. Without an established intellectual discipline through which a person must pass successfully before he can be labeled a consultant, it is difficult to make valid judgments about who is or who is not a professional. However, ACME does have a well-developed program in this area and is working on the development of minimum standards for consultants." — *Think,* March 1960.

Consulting Employees in Union?

"A U. S. high court has refused to review the decision of a lower court which ruled that consulting firm employees may be required to abide by contractor-union agreements insofar as union membership is concerned. The case, involving the Marysville, California, consulting firm of St. Maurice, Helmkamp and Musser, arose when operating engineers struck a job to force the firm's employees into the union.

"Basis for the strike was a contractor-union agreement calling for 'subcontractors' to deal with the same union as the prime contractor. St. Maurice, Helmkamp, and Musser argued that the agreement in question took away their employees' right to choose their own representation. The National Labor Relations Board, while condemning the strike, ruled against the consulting firm. The decision was later reaffirmed in court action." — *CEC Newsletter,* February 1960.

Russian Patents

"Any would-be patentee of inventions in Russia receives a guide to practice and to the treatment he may meet in a report on 'Soviet Patent and Trade Mark Law' prepared by the Patent Office delegation that visited Moscow last December and published by the Stationery Office this week. Patents as we know them are a rarity in Russia. An inventor can obtain a certificate of authorship, or an 'attestation' for an improvement to existing technology, which is classified as a 'rationalization proposal.' Even scientists who establish new objective laws, properties or phenomena of the material world can get a diploma to certify their discovery; and all three entitle their holder to rewards from the state in proportion to the value that it sets upon the invention or discovery. A Russian can take out a patent if he wishes; but if he does, he loses the right to a reward, has to pay fees, no longer gets the first 10,000 roubles of payment for any certificate of authorship tax-free, and has in effect to negotiate with the state for royalties. Not surprisingly, virtually no patents are taken out by Russians; foreigners account for the 100 or so a year that are still reluctantly granted.

"A Russian patent is superficially similar to one abroad; but the patentee can negotiate for its use and his royalties only with state concerns. He obtains the right to prevent others using the invention in Russia without a license from him, and to stop others importing goods covered by the patent. But the government has the power to issue a compulsory license, and to fix the royalties to be paid under it. Remedies for infringement seem to exist more in theory than in practice: there is a body of lawyers who can act for foreign clients, and infringement actions can be brought in the civil courts, but none has in fact ever been heard. The cost of maintaining a patent rises progressively through its life, totaling £1,550 over its 15 years of validity; so most foreign patentees, unless they plan to sell their patented product in Russia, are likely to see little value in the exercise, even though the Patent Office report sug-

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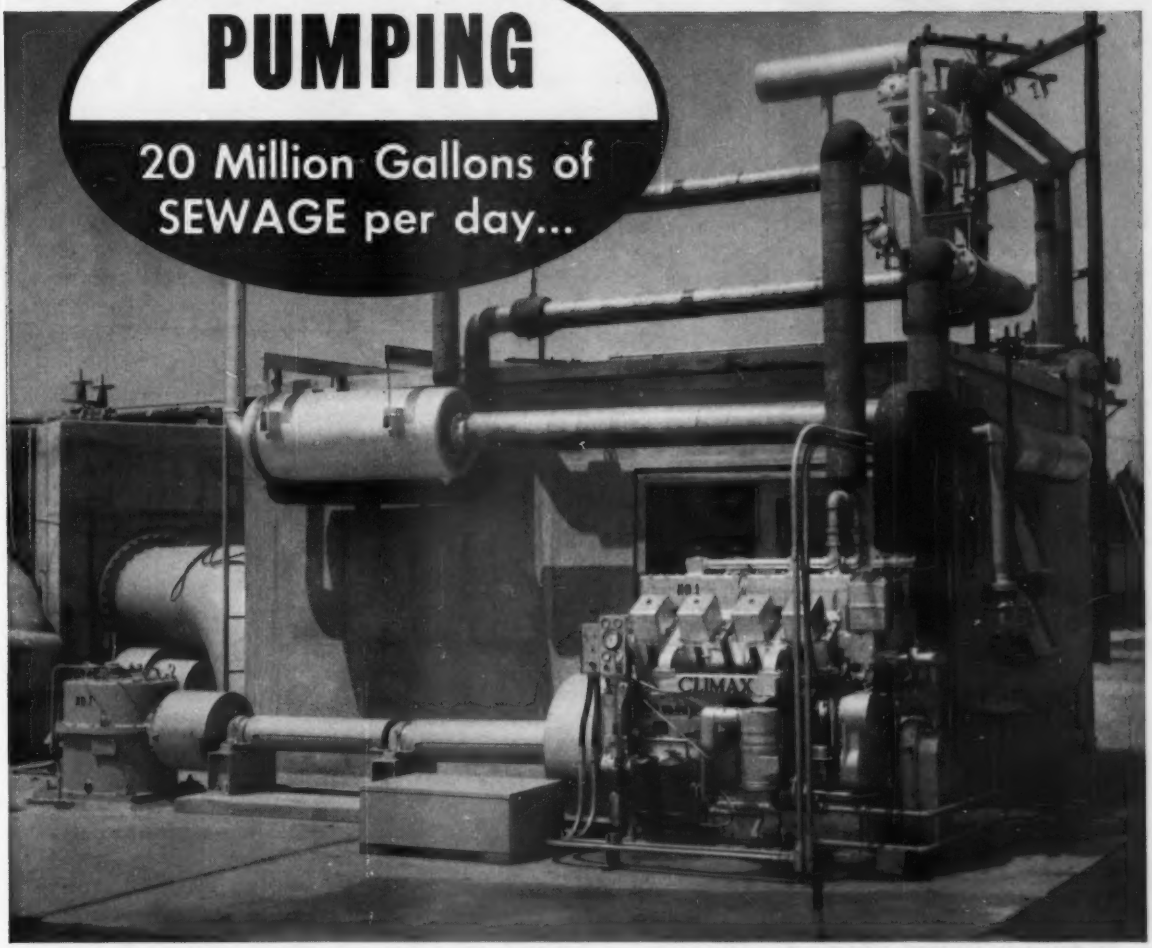

at Orange County, California, Sanitation District

two CLIMAX V-85 ENGINES *power the pumps*

Driving centrifugal pumps, two Climax V-85 Engines running at 775 rpm, pump approximately 20 million gallons of sewage per day in Plant No. 1 of the County Sanitation Districts of Orange County, Calif., at Ellis and Verano Streets, Santa Ana. These V-85 Climax Engines —8-cyl., 7½-in. bore x 7-in. stroke, 2474 cu. in. displacement—are burning sludge gas from the digesters; when this gas is not available the engines are automatically switched over to butane fuel. They operate with vapor phase cooling, and the waste heat is used in the digesters. The Climax V-8, unusually compact in design, packs more power into less space. Rugged, too, for durability with dependability in continuous duty sewage plant service. Its famous fuel economy is built-in. For all its plus-value features in detail, get Bulletin SA-584.

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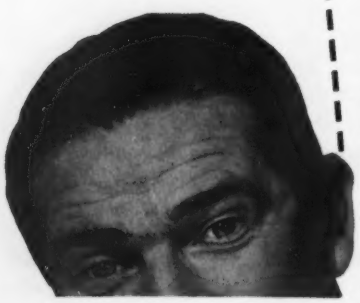


gests that they have nothing to lose but their fees." — *The Economist*, March 12, 1960.

The Space Age: Its Meaning

"By the mid-1960s we will more fully appreciate the meaning of the Space Age in terms of the relationship between our own national economy and the achievements of our space programs. Looking back, we will realize that a preoccupation with missiles for solely military purposes was as shortsighted as the view, 1910 to 1920, that the airplane was exclusively a military vehicle, an ultimate weapon that would put an end to warfare forevermore. We will come to realize that while the landing of a man on the moon was a brilliant scientific-physical achievement, its greater significance was in the clear evidence that the economic, scientific, and engineering standards of the nation that accomplished it were far in advance of the backward nuclear-air-age nations with which it was in competition.

"By then we will understand that space is the great strategic arena in which the future of mankind will be resolved. Either we will have the vision to see the meaning of the Space Age in terms of our own economy and our own survival, the courage to make the decisions that must be made, and the industry, both as individuals and as people, to make that vision a reality, or we will not survive with a way of life as we now know it." — James M. Gavin, Arthur D. Little, Inc., in *Mechanical Engineering*, March 1960.

Engineer Not "Low Man"

"When are we going to stop kidding ourselves by trying to compare our profession with the medical profession as to status, prestige, and public respect. It is only the architects themselves that feel that there is any similarity. Let's face it . . . we are the last man on the bottom of the totem pole as far as the public is concerned, and the sooner we realize it the better off the profession will be. Maybe then we will take steps to remedy the situation." — From a letter to the editor published in the *AIA Journal*, February 1960.

Construction Growth Predicted

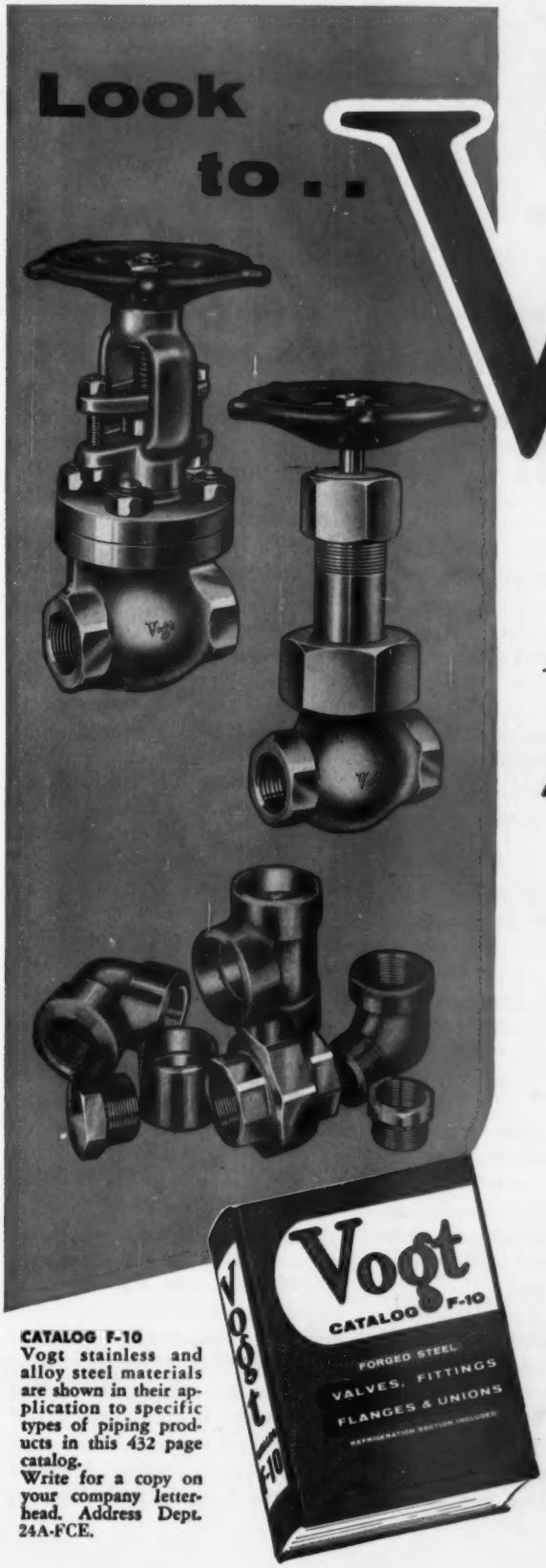
"The continued growth of construction is as inevitable as the growth of our country and its population, and the steadily increasing needs and desires of mankind. In every year since the end of the Second World War the dollar volume of construction activity has risen to a new record. Last year the total volume surpassed $73 billion, including both new construction amounting to $54.3 billion and about $19 billion of maintenance and repair work. Barring an unforeseeable catastrophe such as another great war or an economic depression like that of the 1930s, the total volume of construction 10 years from now should far exceed $100 billion. That is a conservative estimate. It is my guess that it will exceed $110 billion, in terms of dollars of the same value as today's.

"I believe such an increase is certain, and an even greater one possible, because of the enormous accumulation of backlogs of needed construction, and because of the steady growth of the American economy. The backlogs of needed community facilities are actually growing larger all the time. In other words, instead of catching up on these backlogs, we are falling further behind. That is because of the unusually high rate of increase in our population in recent years and the rising needs and desires of the American people for more and better community facilities, such as highways and streets, water and sewer systems, schools, hospitals, churches, libraries, and shopping centers.

"To illustrate how we are falling further behind on community facilities, I want to recall some esti-

Look to..

Vogt



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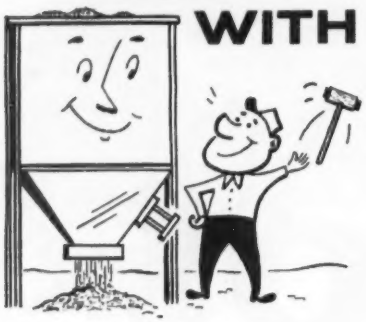

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mates made by President Eisenhower six years ago in his Economic Report to the Congress. The President said in 1954 that in order to catch up on backlogs of community needs it would be necessary to spend:

¶ For highways, $8 billion annually for 10 years.

¶ For schools, $6.75 billion annually for 10 years.

¶ For water and sewer facilities, $1.8 billion annually for five years.

¶ For hospitals, $1.5 billion annually for 10 years.

"These items add up to more than $18 billion a year — and today we know, better than we did six years ago, that those estimated requirements were conservative. Yet in no year since 1954 have we spent anything like as much as the estimated requirements of six years ago in a single one of these categories. And total expenditures for all four categories have run less than two-thirds as much annually as we thought we needed to spend six years ago." — John Volpe at the *National Construction Industry Conference.*

More on Highway Investigations

"The Federal-aid highway program is now under review and study by various agencies and committees. This scrutiny involves not only the conduct of the program but certain basic concepts on the Interstate System and the legislative intent behind the successive Federal-aid acts.

"These various reviews are exhaustive and thorough. One of their announced aims is to reduce the cost of the Interstate System and one of the major areas of study is the scope and cost of the urban portion of the System.

"These reviews can be a healthy thing in our form of government if they are conducted objectively and from the point of view of constructive analysis of the program. If, on the other hand, they are used as instruments of destruction or harassment, they are of no value and they waste the time of responsible officials who should be engaged in productive effort.

"It is particularly necessary during these reviews and inquiries that the public get both sides of the story. Otherwise the public must form its judgment on the basis of the facts or assertions which reach it." — Bertram D. Tallamy, Federal Highway Administrator, at *ARBA Convention.*

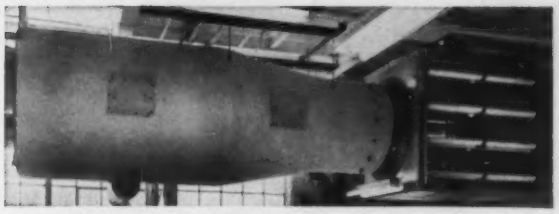
New Psychrometric Chart

"Following the psychrometric chart symposium held at the recent semi-annual meeting of the American Society of Heating, Refrigerating and Air-Conditioning Engineers in Dallas, the ASHRAE technical committee on Psychrometrics met and agreed that a new chart should be developed. It was decided that the new chart should consist of a series of isobaric charts with the pressure differences to be determined after study. It was also concluded that the new chart would be developed around the variables of 'humidity mixing ratio' as the ordinate and 'enthalpy' as the abscissa. With values for these parameters as the coordinates, the wet bulb and dry bulb temperature lines will be at right angles to each other, thus increasing the simplicity and accuracy." — *Heating, Piping & Air Conditioning,* March 1960.

Israel's Water Problems

". . . The Israeli Water Planning Agency is seeking to double the 1956 water supply by 1966, giving the country a total of 14.5 million acre feet (an acre foot is 12 inches of water per acre) per year. A central feature of the plan derives from a survey that I conducted in 1938 and 1939 for the U. S. Department of Agriculture and from the proposal, growing out of that survey, of a Jordan Valley Authority to achieve the fullest development of the surface and underground waters of the valley for the entire original Mandate under the League of Nations, in-

17 reasons why the Carrier Rotaspray Weathermaker System is



Carrier Rotaspray units may be installed rooftop mounted, ceiling suspended or outside wall mounted.

TODAY'S BIGGEST INDUSTRIAL AIR CONDITIONING NEWS!

1. Proved in use. Now in its fifth year of use in many different applications, the revolutionary Rotaspray® Weathermaker System* has proved itself vastly superior to conventional close-control systems.

2. Unitary design. Instead of one large conventional central station system serving several departments, each department has its own Rotaspray unit and can change its temperature and humidity to meet its individual needs.

3. Smaller apparatus size. A Rotaspray unit requires less than ⅓ the space of a conventional system of equal capacity, due to its high velocity design.

4. Reduces cleaning and maintenance costs. Rotaspray units, with exclusive self-cleaning design, require very little maintenance.

5. Needs no apparatus rooms. No rooms are required to house Rotaspray units, even when located outside a plant.

6. Lasts indefinitely. Rotaspray units, constructed of stainless steel, deliver a long life of trouble-free service—eliminate the need of cleaning and painting.

7. Eliminates many system components. Because of revolutionary system design, Rotaspray units need no water strainer, no water pump, no water tanks, no city water and drain piping, no apparatus room and no floor drains.

8. Needs no air filters. Instead of trying to keep dust and coarse particles out as conventional systems do, the Carrier system draws them in, separates them from the air and returns them to central point for automatic collection and disposal.

9. Better humidity and temperature control. By a new control method, the Rotaspray System eliminates dewpoint control and its problems. Within system capacity, departments simply "dial" the temperature and humidity required.

10. Low operating weight. Since Rotaspray units are smaller, require no enclosure, and have no standing water level, their weight is relatively low and units may be ceiling suspended or rooftop mounted without additional building reinforcement.

11. Constant air supply. Conventional systems use automatic dampers which close down and reduce the amount of air delivered to the room. Though this causes variations in temperature and humidity, it is a "must" in such systems to prevent excessive operating costs. With the Rotaspray System, air is always constant, yet operating economy is superior.

12. Longer fan life. In conventional systems, the fan is on the unit's leaving side where high humidities cause excessive corrosion. The Rotaspray unit, with the fan on the entering side where humidities are lower, greatly lengthens fan life.

13. Relocates easily to meet plant changes. Rotaspray units require no housing, are small enough and light enough to allow easy relocation.

14. Allows lower air quantities. Rotaspray Systems require from 5 to 10% less supply air than conventional systems. Result: better air distribution and smaller ductwork.

15. Eliminates "compromise" temperatures and humidities. With the new Rotaspray System, exact conditions can be maintained in each department. One area is not dependent upon another.

16. Install evaporative cooling now—simply add refrigeration later. When a conventional system is converted from evaporative cooling to dehumidifying service, many extensive modifications are required—such as the addition of chilled water lines, water storage tanks, etc. With a Rotaspray System, none of these must be added. Except for minor changes in the control system, the only need is the addition of a water-chilling machine.

17. Provides more at a competitive price. Though individual plant conditions vary, on the average you pay no more for a Rotaspray System than for conventional "high-quality" systems. And you get a lot more back in efficiency, economy of operation and maintenance savings. For information about the revolutionary Carrier Rotaspray Weathermaker System, write Machinery and Systems Division, Carrier Corporation, Syracuse 1, N. Y.

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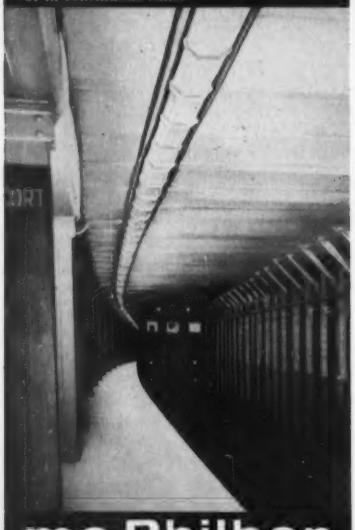

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cluding what is now the Kingdom of Jordan as well as Israel. That proposal called for the development of ground waters and diversion of the upper Jordan waters within Israel to the dry lands in the south and for the diversion of the waters of the Yarmuk River to the eastern side of the Jordan Valley for irrigation of a promising subtropical region in Transjordan. In order to replace the flow of these rivers into the Dead Sea, salt water was to be brought in from the Mediterranean Sea through canals and tunnels to drop through two sets of hydropower stations nearly 1300 feet below sea level to the Dead Sea. This salt water would not only produce electric power but also would maintain the level of the Dead Sea for the extraction of the minerals and chemicals that are there in fabulous amounts. The plan was declared feasible by an international consulting board of engineers. All parts of the plan that do not require the collaboration of the adjoining Arab states are now being carried out by the Israeli Government. The prestressed-concrete sections of the main 108-in. pipeline that will carry upper Jordan water down as far as the Negev are now being fabricated and set in place in a great trench, and the tunnels to carry it through intervening hills are under construction." – Walter C. Lowdermilk in *Scientific American*, March 1960.

Engineering Enrollment Falls

". . . continued decrease in [engineering], and particularly the decrease in freshmen, is a matter of great concern to all of us. The studies of the Engineering Manpower Commission indicate not only that the demand for engineers is increasing, but also that it is expected to accelerate. Our ability to expand the production of consumer goods to satisfy the requirements of our multiplying population depends upon a large and increasing supply of well educated engineers. In addition, they are needed for our space exploration program and the development of ballistic missiles, and of other weapons of defense. The demand from all of these sources for more engineers will increase in future years, and will have to be met by the students presently enrolled in engineering schools and those who will enroll in the next few years. If the industrial growth of the country and the defense programs are not to be impaired, the trend of the past two years must be reversed. Furthermore, every time there is a readjustment of business activity, the press and the general public should not cry 'wolf' and thus discourage students from undertaking the study of engineering." – B. R. Teare, Jr., president of the *American Society for Engineering Education.*

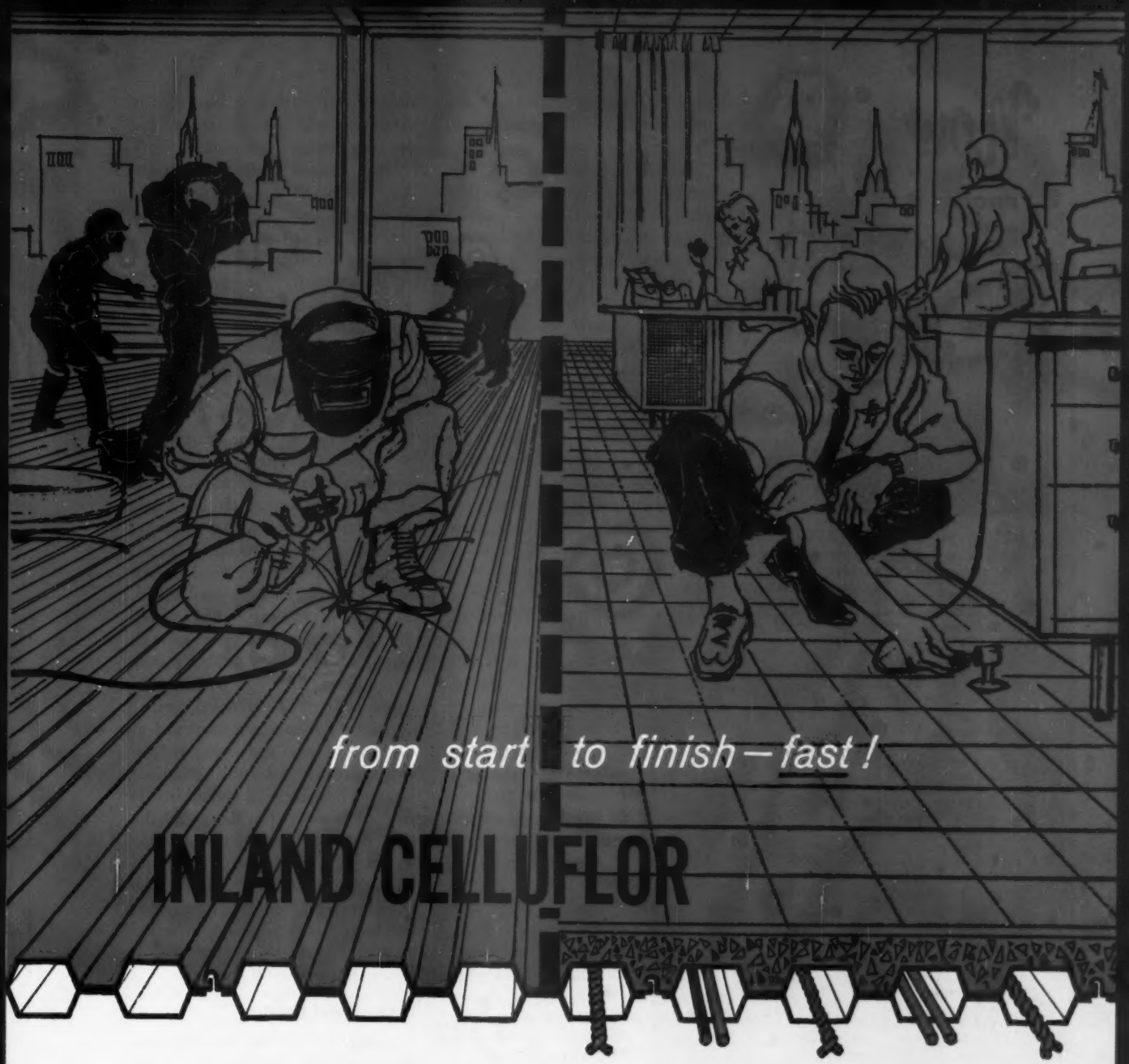
Catalogs Boost Consultant

"If you do not have a registered professional engineer on your staff, HMM always recommends your engaging an independent consulting engineer for any waterworks improvements. We will be happy to work with him." – *H. M. Mueller Corp.*, in their literature on water treatment.

German vs. U. S. Engineers

". . . The major difference between the educated and graduate engineers of the U. S. and Germany lies in the great number of German medium-trained college engineers, as compared with the relatively small number of academic-trained diploma engineers. This is reversed in the U. S. Germany relies as much on the work of the college-trained engineer as American industry relies on engineers with bachelor degrees.

"You would expect both groups, depending on their experience, to be able to calculate and design gears, steam turbines, diesel engines, cranes, etc. For instance, the American engineer may be able to do more advanced work with respect to stress and vibration analy-



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Complete information on Celluflor is given in Catalog 270. Write for your copy—or see Sweet's, Section 2b/In. For help on specific problems, call your nearby Inland office. A trained sales engineer is available for consultation.

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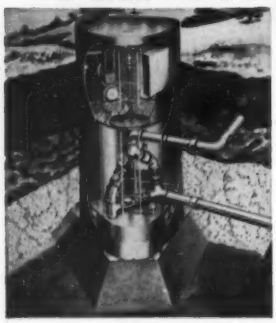

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sis, but his German counterpart has more experience with actual design work.

"The German engineer is less reluctant to make the drawings himself. When the German decided to be an engineer, he saw himself as an engineer who could design and build test machinery; not primarily as a sales engineer or administrator. During his first years in business he may do nothing but design machine parts in detail and make necessary calculations. Most diploma engineers start in the same way, distinguished probably only by a more difficult and responsible task.

"The organization structure within which the German engineer works may be described as autocratic (but it is autocratic with 'back talk'), and the individual is left some elbow room. While the relationship between employees and supervisors is good, it is not outwardly easy-going. A German immigrant engineer working in this country is surprised to find what he thinks is a lack of individualism, of individual drive and fight for personal conviction. He has seen committee work only within trade organizations on standards and codes. Intramural committees, so familiar and necessary in this country, are looked at with distrust by the German engineer. They seem to complicate his work and permit the individual to dodge responsibility." — H. Walter, *Power and Fluids from Worthington*, Vol. No. 2, 1960.

On Aid to Bolivia

". . . In the field of technical assistance, the U. S. started sending technicians and engineers to help [Bolivia] in the improvement of public health, education, agriculture, and transportation. All the necessary equipment needed for carrying out these programs was paid for by the U. S. government. These programs are being carried out in such a way as to acquaint Bolivian personnel with new techniques, so that they can eventually take over the management of the program without further aid.

"The United Nations Technical Assistance Office also started a parallel program to aid in educating and improving the standards of living of the people.

"Undoubtedly the core of the whole aid program lies in technical assistance. Although some people claim that it is going too slowly, I believe that many of its goals are being accomplished. In only five years, vast areas of land have been cleared for agricultural production, with the help of U. S. technicians and equipment. Most of the important roads are open on a year-round basis; something unheard of before technical assistance started. A much needed civil service system is being established.

"There is only one field in which the U. S. has not put enough emphasis. This is the field of public information. Although not directly connected with foreign aid, proper and efficient information aimed at the people who are being helped will probably make the difference between success and failure. It seemed to me at the time, that the United States Information Service was not placing enough stress on telling the Bolivian people why the U. S. was helping them and that the help had no strings attached to it." — Antonio Mettewie, *HNTB News*, January 1960.

Business and Politics

". . . why doesn't the business man overcome his distaste for "dirty politics" and throw himself into the political arena and personally work to correct the abuses of which he complains? Revolutionary as this about-face would be, it would electrify the country.

"My generation abandoned the political arena to the professionals . . . It can now be recaptured by younger men if those presently at the management controls will give the go signal."—Clarence B. Randall in *Dun's Review*, March 1960. ▲▲

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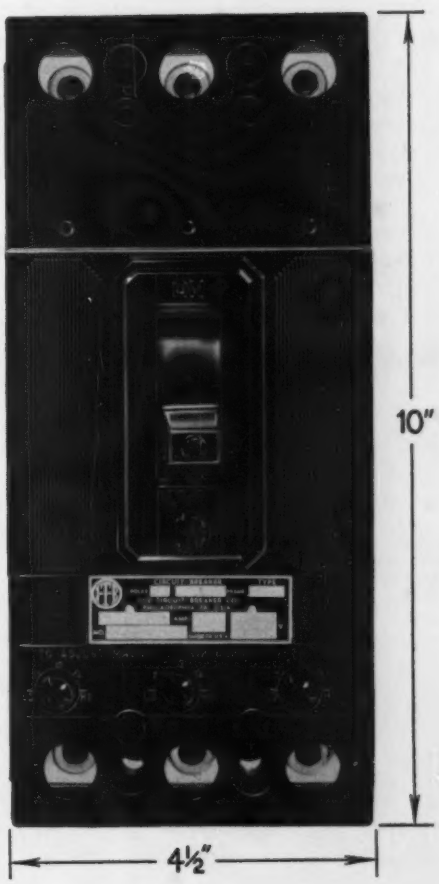

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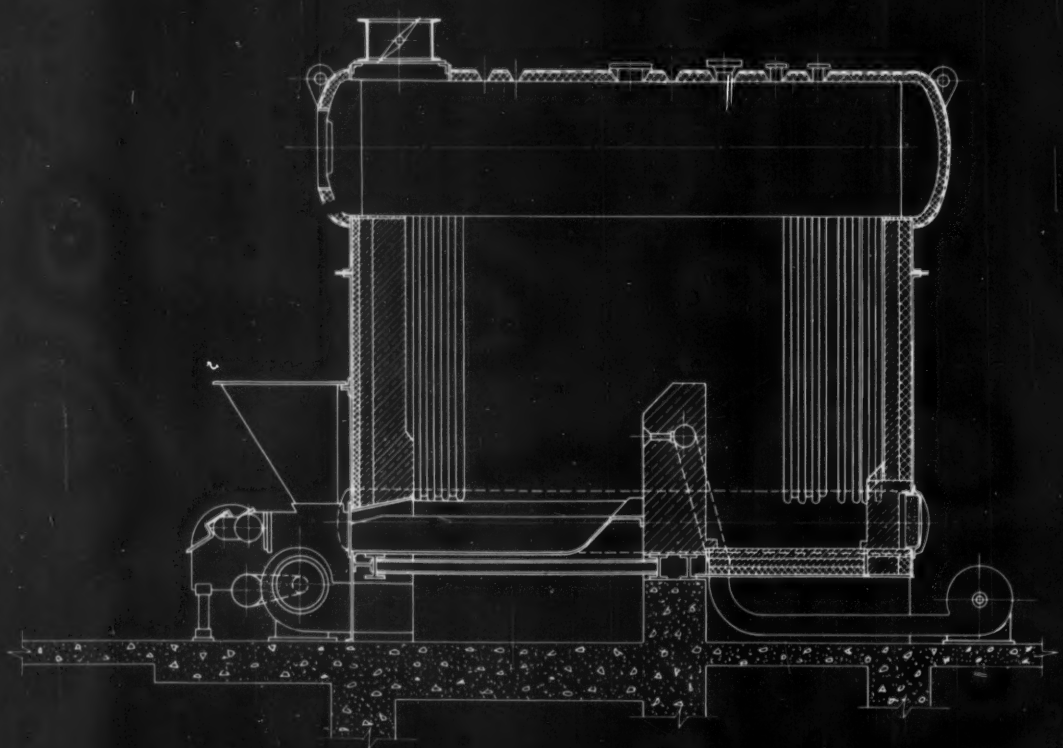

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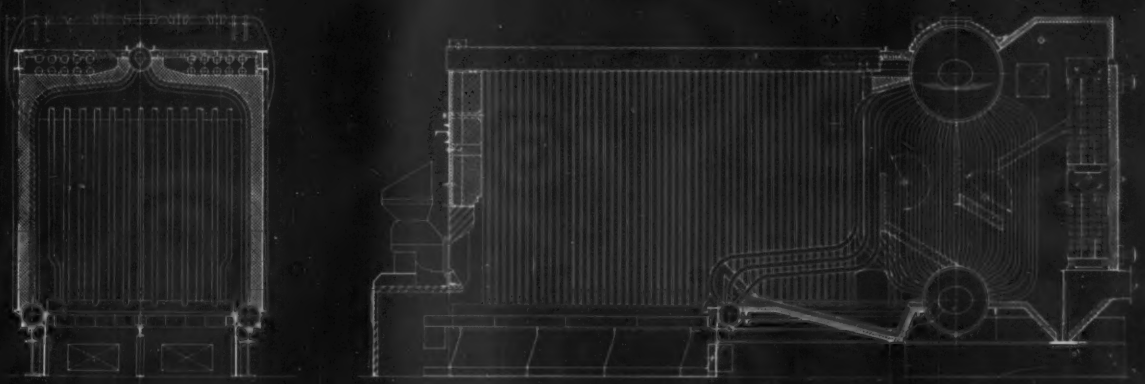

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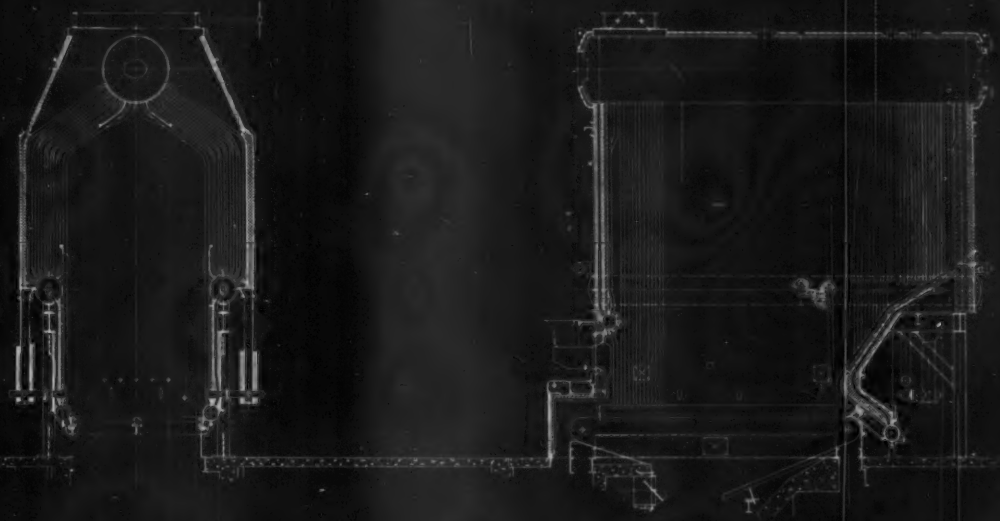

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Anaconda Durasheath has a new clean-stripping, semi-conducting tape

The megohm meters (above) are measuring the surface resistivity on two samples of high-voltage, rubber-insulated, Shielded and Neoprene-jacketed cable immediately after the semi-conducting tape has been removed. The sample on the left (with a megohm meter reading in excess of 100 megohms) is Anaconda Durasheath incorporating the exclusive clean-stripping, semi-conducting tape. For comparison, the cable on the right with a low reading typifies old-style cable manufactured without semi-conducting tape.

The old-style cable requires tedious surface filing and buffing before it is clean of conducting particles, and ready for the tape build-up necessary to complete the splice or termination. Even after all these preparations, the surface may still be conducting because of the semi-conducting particles remaining deeply imbedded in the insulation.

New Anaconda Durasheath eliminates the need for excessive filing and buffing. Because the semi-con tape strips clean, the bared Durasheath insulation surface is left with only slight traces of easily

"Meggers"—courtesy James G. Biddle Co., Philadelphia, Pa.

LASTING JOINTS AND TERMINATIONS ON HI-VOLTAGE CABLE

removed semi-conducting particles. The meter readings will show that a moment of buffing is all that's needed to complete surface preparation for tape build-ups and the most reliable splice or termination possible today.

The planned research and production program which brings you this outstanding cable development is also responsible for the equally important developments in Butyl rubber insulation compounding, and extruding, which have produced the best possible balanced design and construction in high-voltage rubber-insulated cable obtainable today—Anaconda Durasheath.

To make specifying Anaconda Durasheath easier and more confident, write for Anaconda Bulletin, DM-5903, covering Durasheath High-Voltage Cable and DMS-5566, 5720 and 5735, dealing with the splicing and terminating of Durasheath Cable. Contact your nearest Anaconda Wire & Cable Company District Office, or write to 25 Broadway, New York 4, N. Y.

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Problem: How to Microfilm Old Drawings So They Can Be Read

Microfilming is widely used for recording and storing the mountains of drawings and data individual companies must maintain. But to anyone who works with microfilmed drawings, they know the condition of the original is very critical in order to obtain a readable microfilm print. Faint lines, weak lettering and dimension markings, creases, and dirt smudges become impossible handicaps when the originals are first reduced 16 to 29 times and then enlarged for reading or reproduction. Today's advanced drafting techniques avoid this problem in new drawings, but what about a company's old drawings? Few are ever suitable for microfilming without extensive, meticulous restorative work. Yet, something must be done with these old drawings if the microfilm file is to be complete and useful.

Dietzgen answers this problem with a number of products and techniques developed for restoring old drawings

Dietzgen's "wash-off" process puts new life into old drawings quickly and inexpensively.

preparatory to microfilming. The Dietzgen "wash-off" process is preferred by many because no darkroom work is involved. Corrections are easily made on the "wash-off" media eliminating the tedious retouching of a photographic negative. Backgrounds come clean with a wipe of a brush or sponge so that even the finest line stands out sharp and clear.

Today thousands of old drawings which appeared hopeless subjects for microfilming have been salvaged by Dietzgen products and techniques . . . and it's this experience which can prove invaluable to you if old drawings have handcuffed your company's microfilm program.

JETS, MISSILES AND DIAZOS

A large manufacturer of components for jet aircraft and guided missiles complained: "We're having trouble getting all the prints we need each day with our present printmaking facilities. We must step up our printing speed. However, we want to standardize on blueline diazo prints and would like to run our printers at very nearly a constant speed. Also, we have to work with a wide range of reproducibles, which really complicates the problem."

Four companies coating diazo papers were given the problem. Two immediately said it was impossible. The third submitted a specially coated stock which provided the speed but not the print quality required.

Dietzgen had answered similar problems before. With a slight formula change in one of the regularly catalogued Dietzgen diazo papers, the extra speed was added to all the other needed characteristics already in formulation. This custom-engineered product was tested and immediately adopted. It has since been used continuously for the company's large volume needs and is pronounced "perfect." Print production soared.

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This new 36 page booklet describes a wide variety of engineering and production problems that have been solved with advanced techniques in drafting and printmaking pioneered by Dietzgen. The concise, problem-solution approach suggests ways in which you may improve the efficiency within your engineering department or eliminate production bottlenecks. Write today on your company letterhead for the Mechanics of Modern Miracles. Ask for Publication SPD2-D-79, Eugene Dietzgen Co., Chicago 14, Illinois.

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Field Notes

MARJORIE ODEN,
Eastern Editor

In New York State . . . Carroll Report Hits Consultants

MORE THAN a year ago ("Field Notes," April 1959), New York State Senator John H. Hughes, of Syracuse, called for an investigation into the methods used by the Department of Public Works in awarding contracts to consulting engineers. At the time, he was quoted in an Albany newspaper as saying he "objected to the procedure under which the Superintendent of Public Works had sole authority to let a design contract to a consulting engineering firm without advertising for bids or giving public notice."

Project Slow in Developing

Senator Hughes' project did not fare too well. He was appointed a one-man investigating committee, and under Senate rules, one-man committees cannot call hearings. So the Senator decided to have John Benjamin Carroll, chief counsel to his one-man committee, prepare a report.

The report, said to have been completed in June, did not show up until late January 1960, when a photostatic copy "accidently" fell into the hands of an Albany newspaper. Sensational newspaper stories appeared throughout the state —some of which were more confused than the report.

Senator Hughes said he "personally" had locked up the Carroll report because he "felt it was based on hearsay."

Senator Mahoney said, "I regret exceedingly the premature publication of the Carroll report on consulting engineers before resolution of the legal questions surrounding it. In view of its disclosure, I shall confer next week . . . to determine whether any legislation will be required to correct the conditions outlined in the report."

The offices of Senator Hughes and Senator Mahoney both found they had "no copies of the report available," but copies were easily come by if anyone was really interested. Here are quotations from a copy of the report prepared by Chief Counsel Carroll:

"At my request, certain studies were conducted by the Department, which will be referred to hereinafter. It should be pointed out that some of the officials involved completely destroyed or carried away documents which bear upon the subject of the investigation before leaving office . . .

"In general, the engineering profession computes its fees directly or indirectly on a cost plus 100 percent basis. Since the percentage paid by the State for large dollar volume work, such as interstate highways, computes out at more than the normal figures, it would be fair and conservative to divide these fees by half to arrive at the gross profit of the members or participants in these firms. Therefore, some engineering firm members or partners would have earned $500,000 to $1 million in fees in a few years, all above and beyond their gross costs, on the work for New York State. This would not include the extra work performed by almost all these firms for private corporations, individuals, other states, other countries, or the Federal government.

"I was advised that as a result of the highly remunerative aspects of this work, many of the private firms aggressively seek to be awarded these contracts and have employed or retained personnel who are well-connected, particularly with District Engineers and main office personnel, and have maintained social contacts and arranged social affairs for the important personnel of the Department, such as country club parties, and have during the last administration carefully cultivated personnel within the Department who could advise them of the pendency of a contract. I was advised that on more than one occasion the expenses of Department personnel were paid by members of these firms . . .

"An example of the coming together of the worst of the defects

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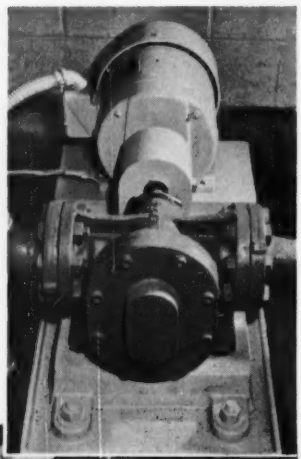

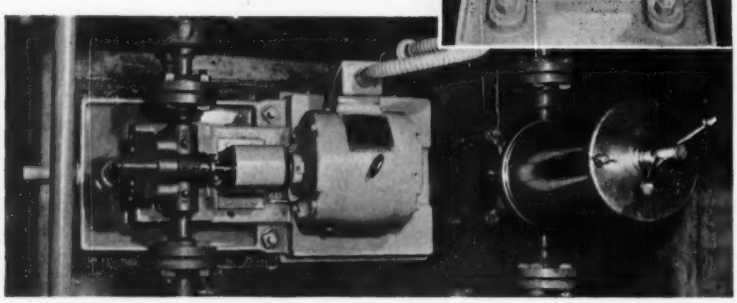

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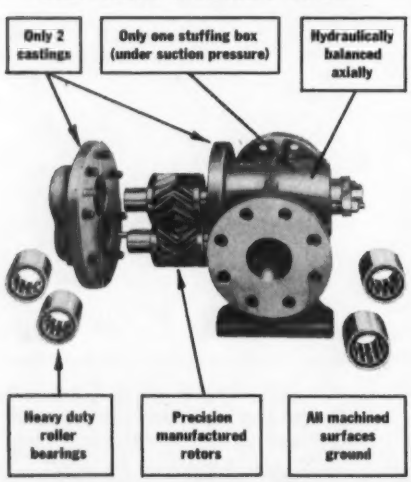
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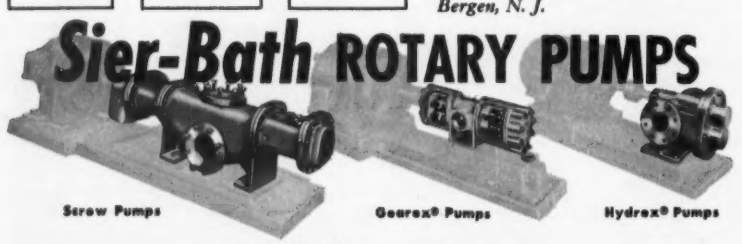

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and irregularities occurred in November and December 1958.

"In one afternoon in the latter part of November the Department, with top exempt officials participating (including the Superintendent), awarded survey and design contracts for $158,685,000 construction, and supervision and inspection contracts for $39,404,474 for a total of $198,089,474. The total fees to private firms for this work were $8,940,991 . . .

"In the vast majority of projects there was no rational basis for an estimate of cost of construction, upon which fees could be computed and proper obligation of funds made. In some cases the location of the route had not yet been determined. In others, there was no legal authority to build the road which was sought to be built. The vast majority had not had public hearings in the manner required by law or sound policy. Some of the projects were being done by the District Engineers with their own forces.

"The information that I have as to the selection of the projects indicates that some projects were selected to silence newspaper criticism, particularly in the Albany and Syracuse areas; some because of complaints of local officials that nothing was being done; and some because the District Engineer sensed that the eagerness of the main office presented a good opportunity to bargain for projects that had long been turned down and this official had his projects listed on quid pro quo basis . . .

" . . . the main office overruled the District Engineer and selected firms not nominated, contrary to the written rules if not the general practice for the selection and nomination of a private firm, which provide that the choice is between the three nominees of the District Engineer. One of the firms selected by the Superintendent was the firm of which the Superintendent is now a partner, and from which he is entitled to draw the profits from

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the contracts he awarded. It is, of course, not possible to ascertain when a relationship between the Superintendent and the owner of this firm first arose. . . . The partnership was publicly announced January 2, 1959, by printed cards. Documents show that one of the Superintendent's last acts was the approval of an increase in fees in contracts to this firm in the latter part of December 1958, so that it seems beyond argument that the partnership was viable at the time of the increase."

Superintendent Replies

Here the Carroll report is referring to the firm of William McFarland, of Binghamton, which Superintendent John W. Johnson joined in January 1959. The firm is now Johnson and McFarland.

The *Binghamton Press* gave Johnson a chance to tell his side of the story. "I had 12 offers from private engineering firms after the election. I did not make up my mind until late December. They were very good offers, and it takes time to decide . . . It makes it look like I committed an awful crime by going to work. I still have a family to support."

Pointing out that the practice of retaining consulting engineers on highway work was in use long before he took office, Johnson added that this was the only way to obtain for the state the maximum available Federal money.

More Press Reports

The affair of the Carroll report resulted in consulting engineers getting rough treatment in much of the New York press. According to the *New York World Telegram*, "A report has come to light that state public works officials have destroyed or taken certain state records pertaining to the award of highway design contracts — but there wasn't anyone around the State House today who seemed particularly interested in doing anything about it."

The *Buffalo News* took a more careful look and stated, "The Carroll report, criticizing Mr. Johnson, might well be termed a smear. At any rate, if there is or was any basis for the suspicions vaguely hinted at, why didn't this special committee of the State Senate go dig them out? Clearly, if Albany legislative leaders had considered the report to be well considered, they would not have held up its publication. That the report finally was 'leaked' added more to sensationalism than to responsible government."

The *Knickerbocker News* (Albany) could see only politics and kickbacks. "Elements in the picture seem to be: Both parties are known to count on consulting engineers in fund raising . . . Over the years we have persistently run into reports that the state's engineers spend much time re-doing work which consultants are being paid for; also that if the state deployed its own forces better it could do more of its own engineering," the *News* reported.

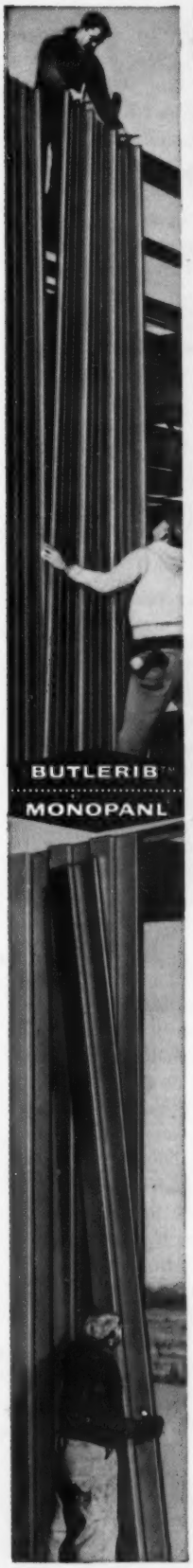
Engineering Societies Reply

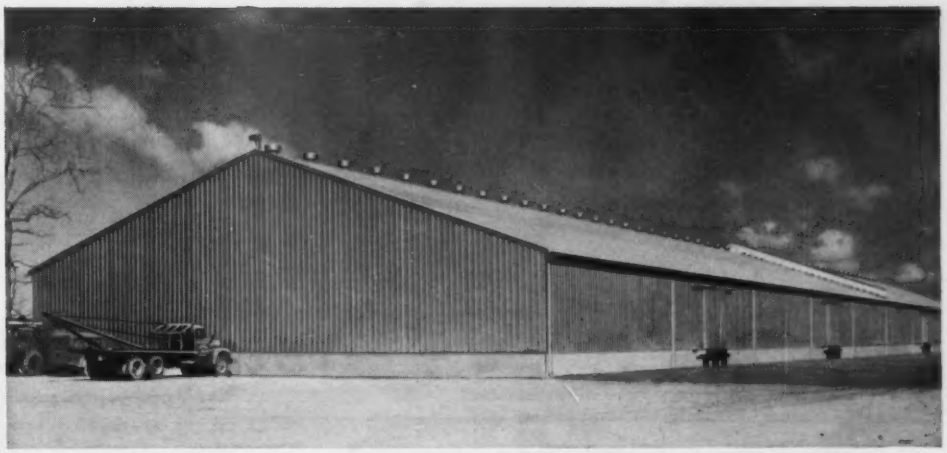
The American Institute of Consulting Engineers, the New York State Society of Professional Engineers, and the New York State Association of Consulting Engineers lodged prompt and well-worded replies.

Implication Denied

The Institute, at its annual meeting on Jan. 18 (more than a week before the first copy of the Carroll report began to trickle about) passed a resolution. Among the objections listed were that "these increasingly frequent and misleading statements are neither supported or supportable, but, nevertheless, unjustly cast the shadow of suspicion over consulting engineering practice, and, hence, over the integrity of the engineering profession as a whole.

"NOW THEREFORE BE IT RESOLVED, That the American





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Institute of Consulting Engineers, at its Annual Meeting, held at the Engineers' Club, New York, N. Y., on Jan. 18, 1960, categorically denies and deplores any implication that either the public or members of the engineering profession — whether publicly or privately employed — will benefit from measures of this or any other kind which advances socialization of engineering in America; for it is to be noted that engineering is not a trade, a commodity, or a manufactured product, subject to severe standardization, but engineering is a professional and creative personal service, the highest public benefits of which have been attained under a system of free enterprise."

Comparisons Should Be Realistic

The Institute further suggested that the government agencies straighten out their accounting systems so costs of design by consulting engineers and design by government employees can be compared on a realistic basis.

Institute President R. H. Tatlow III sent the resolution along to Senator Hughes, along with a letter pointing out that, "I do not believe that the implications are fair, and that, upon thorough investigation, you will find that the use of consulting engineers actually saves money for the State and makes it unnecessary for them to operate peak staffs, when, frequently, much smaller staffs would carry the normal work load."

Tatlow added that if Hughes' committee plans to take up the use of consulting engineering again, the Institute would like to send a representative to appear.

Prove Charges or Withdraw Them

The New York State Society of Professional Engineers and the New York Association of Consulting Engineers both endorsed a statement that Carroll should show the basis of his charges or withdraw them. The report from the two groups states:

"The report (Carroll) as published contains innumerable implications and inaccuracies concerning the fees paid for professional services which give an entirely false impression to the general public. Anyone unfamiliar with engineering matters would interpret from this report that fees and profits are synonymous . . .

"We therefore request that if this committee has any evidence of unethical or illegal practice by Professional Engineers, such information be placed in the hands of the proper authorities so the guilty parties can then be dealt with in accordance with provisions of the law. Thousands of engineers employed by the State and by consulting engineers are now smeared by implication.

"It is our considered opinion that the author of this report should make available the basis of these charges or withdraw them." ▲▲

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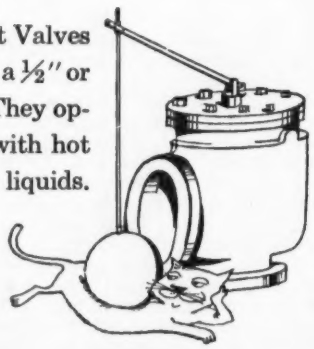

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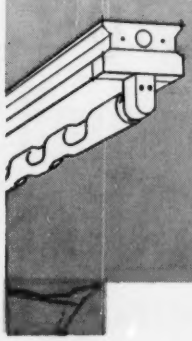

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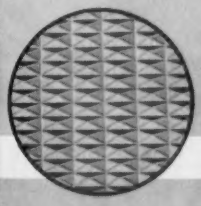

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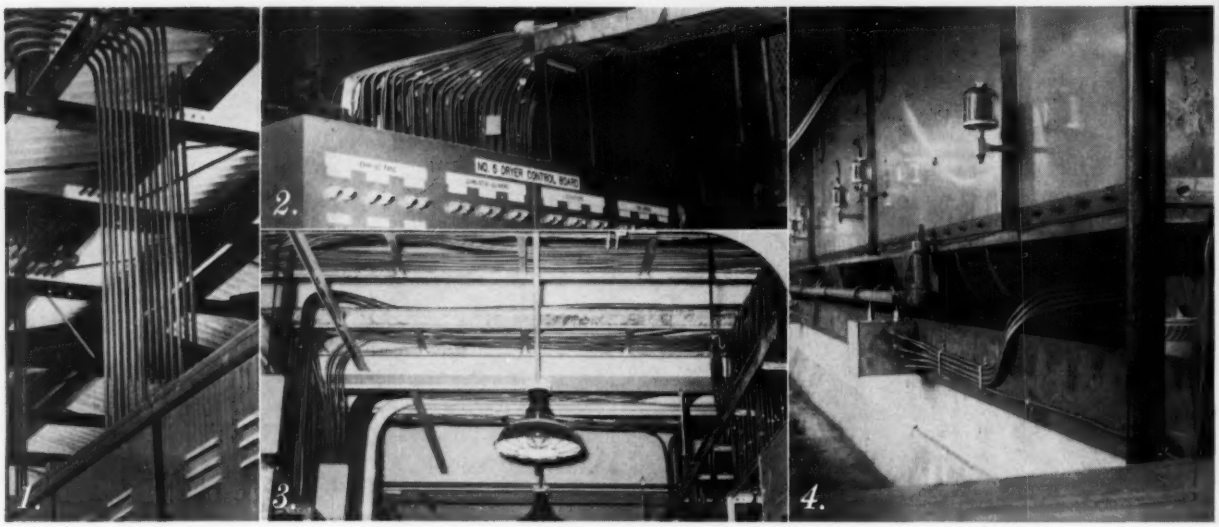

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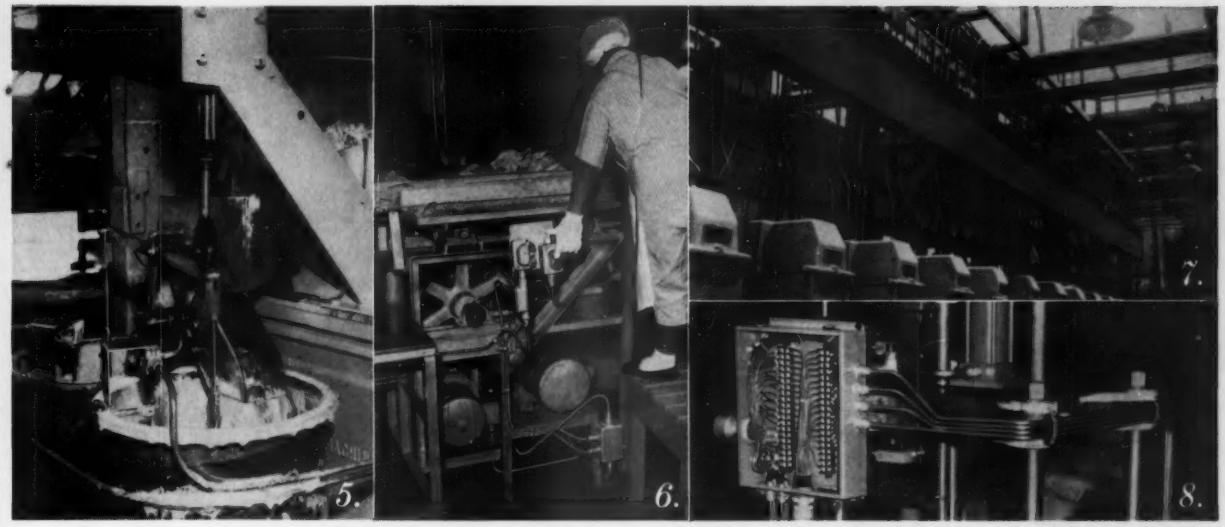

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Scraps & Shavings

Consultants Left Out

The General Accounting Office has sent another report to Congress – this one on Bureau of Public Roads operations in California, Nevada, and Arizona. Right-of-way acquisition and highway geometric design by the state highway departments were criticized, and the report did not mention consulting engineers.

Talent for Sale

At a recent electronics convention, independent recruiters approached companies and described the qualifications and background of engineers who "would be interested" in changing jobs. If the company indicated an interest in the engineer, the recruiter then would approach the engineer and describe the job the company could offer. If the company and the engineer got together, the "independent" middleman collected 15 percent of the engineers' first year salary from the corporation involved in the deal.

Kansas Shake Up

According to *Kansas Consultants*, a few jobs in the State Highway Commission have been changed because the engineers were in control and the Commission did not think this is the way things should be. It was claimed that engineers, and not the commission, have been running the department for years. There are reportedly 400 engineers on the payroll, and the reorganization is aimed at getting more engineering work from them and less from outside consulting engineer firms.

Building Industry Board

The constitution and bylaws of the newly formed Building Industry Conference Board of Santa Clara Valley were ratified by member delegates at the group's monthly meeting in San Jose, California. The following officers were elected to serve this new organization: president, George Thenn; vice president, Otto Illerich; secretary-treasurer, Robert J. Duffey.

The Building Industry Conference Board is composed of representatives from engineering, architectural, and construction trade groups. This organization was formed to provide closer liaison between professional design groups and construction trade groups. The Board will be made up of delegates from 11 organizations, including the Santa Clara Valley Electrical & Mechanical Engineers Association, the San Francisco Section, American Society of Civil Engineers, and the Associated Civil Engineers & Land Surveyors of Santa Clara County.

Italy's Highway Program

The Italian government has embarked upon an extensive new road development program, part of which calls for the expenditure of $480 million on expressways. Public Works Minister Giuseppe Togni also said that other projects would preserve historic Roman sights, join tourist areas, and provide a scenic tourist route. Two of the expressways will connect Brescia and Padova, and Torino and Ivrea, and are expected to be completed this year. Another being started will extend from Fornara to Pontremeli. Widening of the Padova-Mestre and Naples-Bari highways also is being undertaken.

Another $500 million program calls for a parkway preserving the atmosphere of the ancient Appian Way. The first stage of this project, being started this year, calls for rescue of a five-mile stretch of the 23-century-old Way from its present state of deterioration. Later, the parkway will be continued north to provide a more suitable approach.

Parks to the north and west of Rome are to be linked with other new roads, and a scenic coastal highway will extend from the mouth of the Tiber River to Naples. Another road is planned in order to link Rome with the Abruizzi National Park on the ridges of the Apennine Mountains.

The expressway program, according to Togni, will involve 10,000 kilometers of road reconditioning and the elimination of 322 railroad crossings. It is expected that, when completed, the new network will serve needs not only of commercial traffic, but of tourists from other nations as well as the recreational needs of the modern Roman.

Low Cost Power Expansion

The best way of holding down costs for small and medium size utilities that are expanding may be a "steam-gas turbine exhaust fired cycle" instead of the steam-electric combination now commonly in use, according to M. Eisler and W. M. Sybert of Kaiser Engineers. Not only are steam-gas turbine combinations cheaper to

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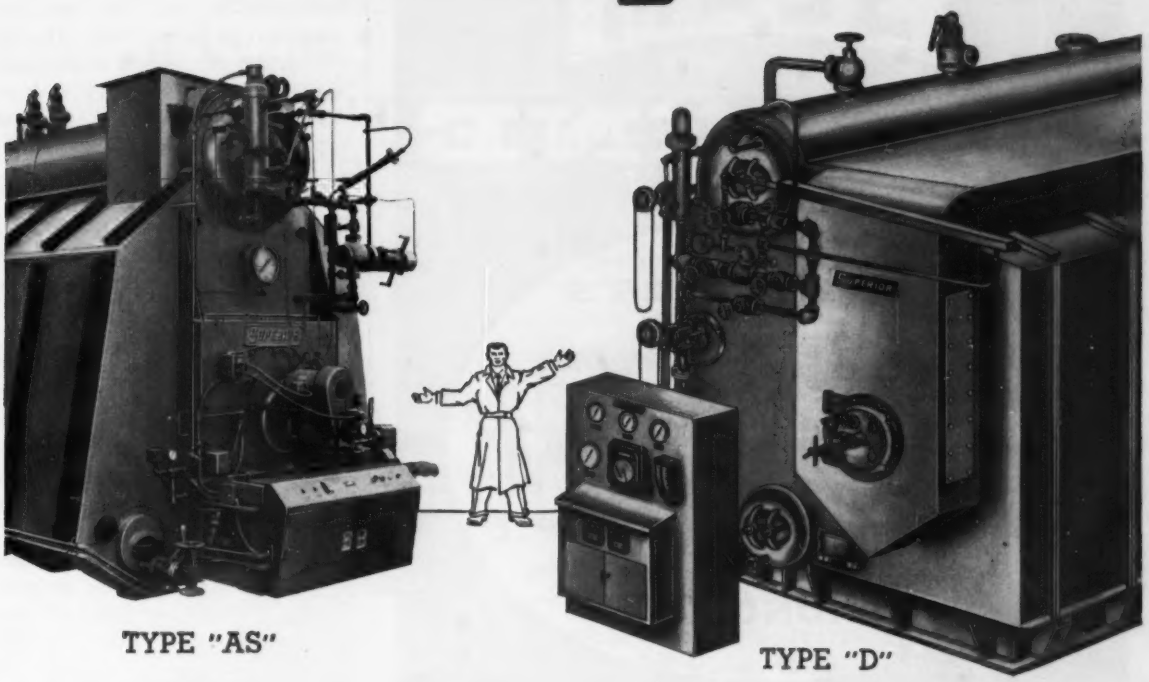

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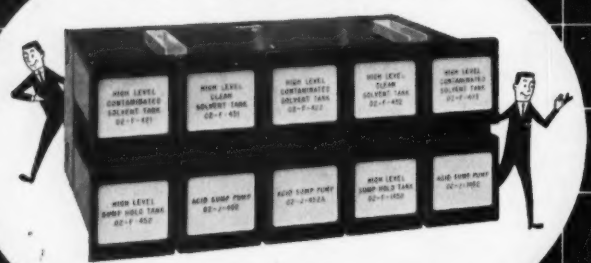
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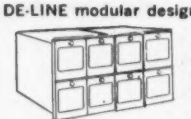

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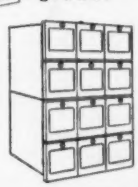

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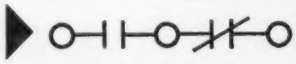

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Loss to Highway Program

The death of Senator Richard L. Neuberger (D-Ore.) removed from the Senate one of the members most interested in highway problems. A member of the Public Works Committee, Senator Neuberger was one of the leaders in the campaign for legislation to regulate billboards on the Interstate System. Last year, when many Republicans were reluctant to endorse the Administration proposal to increase the Federal gasoline tax by 1½¢ per gallon, Senator Neuberger became one of the strongest advocates of the proposal.

Denver Airport Study

The Ken R. White Engineering Company of Denver was selected to plan development of the Jefferson County Airport near Broomfield. Dr. R. S. Cooley, chairman of the County Planning Commission, said the choice was subject to negotiation of a satisfactory contract between the county and the firm.

The announcement came after several months of work by the commission to get a program under way for the airport area. Most pressing of the immediate problems in development of the airport is planing for an industrial park on county-owned land adjacent to the airport proper.

Detroit City Airport

In a report to the Detroit Aviation Commission, the Cincinnati airport engineering firm of Landrum and Brown said the city should spend $4,976,488 in the next 10 years to modernize and expand Detroit City Airport. The firm's recommenda-

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tions, made after a $13,000 study, included: construction of a multi-purpose administration building in a new location; construction of a new control tower; expansion of some runways and discontinuance of others; acquisition of 7.8 acres at the southeast corner of French and East McNichols for future expansion; removal or lowering of water tank and stacks; and installation of a helicopter landing area. It also was proposed that certain trees be removed in Gethsemane and Mt. Olivet cemeteries and that nearby factory stacks be removed or lowered.

Illinois Mechanic's Lien Act

The University of Chicago Downtown Center will present an intensive one-day seminar on the scope and operation of the Illinois Mechanics' Liens Act on April 8 for contractors, subcontractors, material men, loan officers, architects, engineers, and other persons concerned with construction and real estate. Practicing attorneys will discuss various procedures and practices necessary to secure protection and avoid pitfalls under the act. The Illinois Mechanics' Liens Seminar will be held on Friday, April 8 at the LaSalle Hotel, Chicago, from 9-12 a.m. and 2-5 p.m. Registration may be made by mail or at the Downtown Center to April 8.

Standards for Welded Railing

The growing trend toward use of welded railings has resulted in the deletion of typical details illustrating the use of standard fittings in pipe railing assembly from the AISC Handbook. Concurrently, there has been a need for more detailed engineering drawings, since railings are now pre-fabricated rather than assembled on the job.

Since detailing standards vary with individual engineering firms, fabrication procedures have not been uniform and production costs were usually higher than necessary. To remedy this situation, a number of manufacturers met informally

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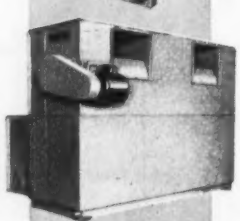
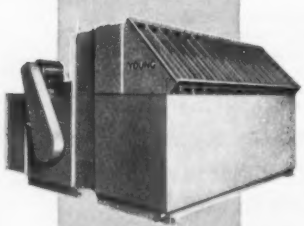


VERTICAL UNITS

Sectionally-designed Vertical Units are available in the same wide range of sizes and capacities. All types feature easy servicing . . . hinged panels make filters readily accessible . . . special filter removal racks are standard on all Filter Sections and Mixing Boxes for fast, easy removal or inspection of filters.



MULTIZONE UNITS

Where independent area control of air conditioning is required from a single unit, Young Multizone Units provide the solution. Nine sizes and a choice of 2 to 21 zones are available. Heating may be provided in one zone while cooling another zone simultaneously.

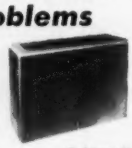
YOUNG OFFERS A COMPLETE LINE OF EQUIPMENT FOR AIR CONDITIONING ALL TYPES OF BUILDINGS

Young Engineers are Pleased to Offer their Services on Any Heat Transfer Problems

Write for FREE Catalogs on any Young Products

Remote Roomaire® Conditioners

Vertiflow® vertical discharge unit heaters



Cabinet Unit Heaters

Young

ideas for solving heat transfer problems are GOOD IDEAS

YOUNG RADIATOR COMPANY DEPT. D-490 RACINE, WISCONSIN

PLANTS AT RACINE, WISCONSIN AND MATTOON, ILLINOIS

and established design and specification standards for pipe railing fabrication. It is estimated that use of these standards will result in approximately 10 percent savings on job costs. The standards may be obtained from Tubular Products, Inc., Souderton, Pennsylvania.

New York World's Fair Head

Selection of the men who will decide if and which consulting engineers are to be used on design of buildings for the 1964 World's Fair in New York City has bogged down—although at press time Robert Moses had shucked most other jobs to become Fair President and Wallace K. Harrison, of Harrison & Abamovitz in New York City, looked like at least a "good bet" to be selected as the head of the Board of Design.

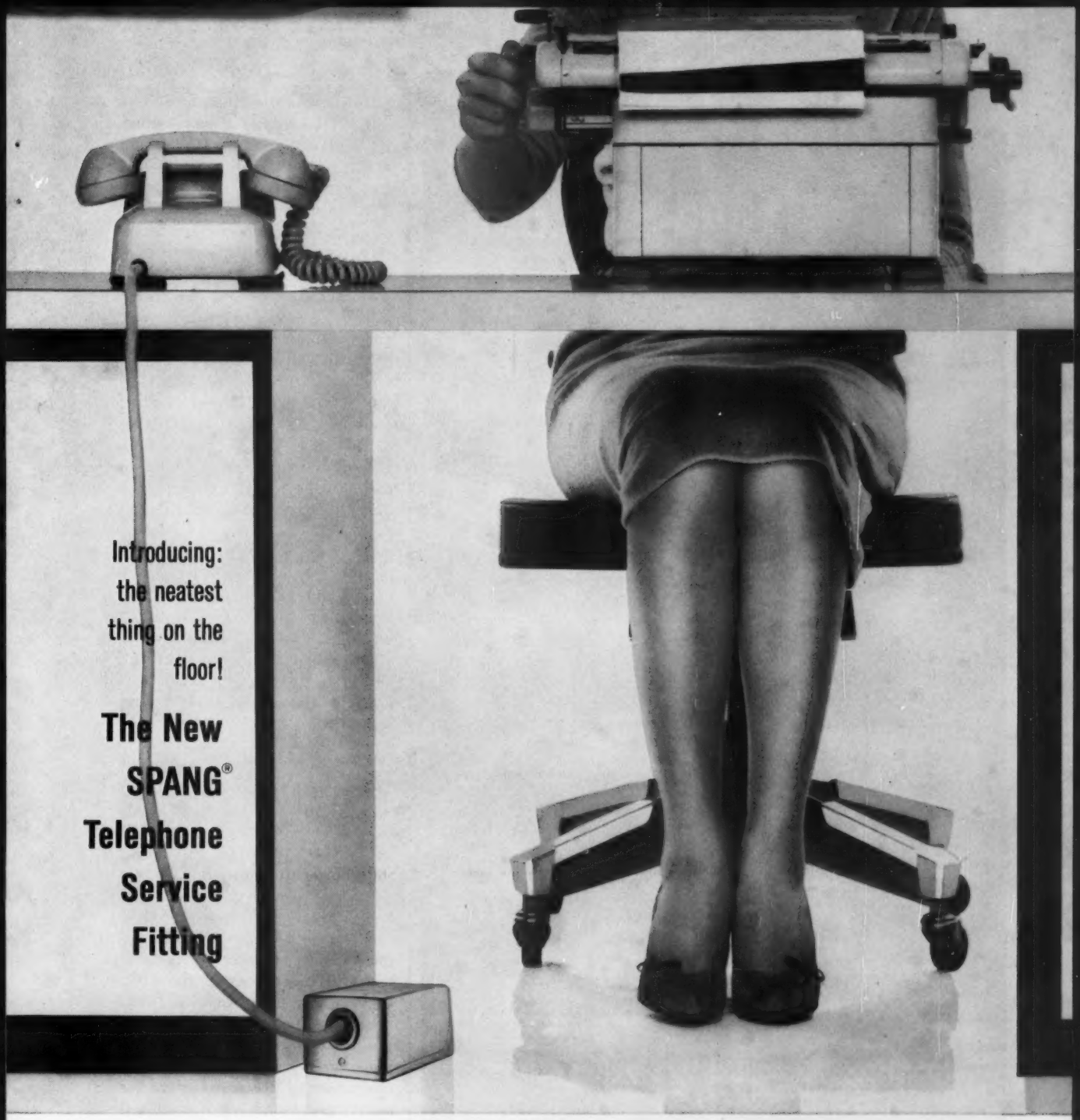
First came an announcement in New York papers that "Harrison May Design World's Fair." Reading further, one became less optimistic than the headline writer. The story sounded more like Harrison might select those to do design rather than do all of the design work himself.

Next came the announcement that Robert Moses, whose titles include that of City Construction Coordinator and Chairman of the State Power Commission, has been asked to become President of the World's Fair. Moses was slowed from acceptance only by his time-consuming job of resigning from other posts.

CONSULTING ENGINEER checked with Harrison's office (which was easier to find than Harrison) to check his willingness to accept the job of heading the design panel. It was stated that, "He has not officially been invited to head the design unit yet. And if he is invited, he might or might not take the job."

Report on Pollution Study

First official report in the St. Louis Metropolitan Sanitary District's 30-month, $245,000 pollution abate-



Introducing:
the neatest
thing on the
floor!

The New SPANG® Telephone Service Fitting

Maximum Utility—This new fitting (Catalog No. 17203), designed to be used for office phones with the maximum push-button requirements, handles four Western Electric Terminal Blocks plus a signal buzzer.

Finest Appearance—The clean, simple lines of the brushed-aluminum fitting case are right in step with today's architectural styling. The tapered shape and low silhouette make the fitting very inconspicuous. It can be placed snugly against the side of a floor-flush desk or can be fitted under a leg desk with room to spare. Dimensions: 6″ long, 4″ wide, 3″ high.

Firm Installation—The fitting employs the same basic method of firm coupling to the duct insert as do all Spang electrical raceway fittings. Once it's installed, it stays flush with the floor—won't wobble or twist from its correct position.

Easy to Work With—Unitized design of top housing saves installation time, speeds changes of circuits when needed. When top housing is removed, all wiring is exposed for easy access.

Complete SPANG Line—The new telephone service fitting joins the Spang family of fine electrical raceway fittings for communication and power distribution systems that offers architects, engineers and electrical contractors the finest fittings you can buy. Remember, when appearance counts most, Spang electrical raceway fittings are your best choice.

P.S. If you'd like more information, write Spang.

SPANG UNDERFLOOR DUCT

THE NATIONAL SUPPLY COMPANY

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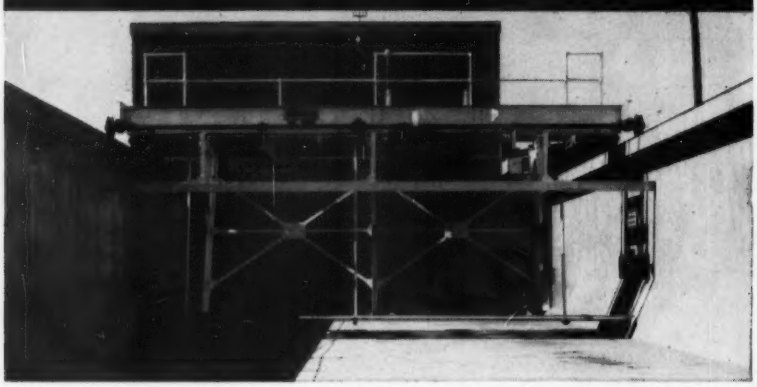
HARDINGE CLARIFIERS for rectangular tanks



The Hardinge Rectangular-Type Clarifier is similar in operation to an industrial, overhead crane. It travels on two rails, on the outside walls of the settling tank, scraping settled solids to a sludge hopper at one end. A skimmer may be added to remove scum and floating material from the tank surface on the "return trip" of the Clarifier.

Advantages of the Hardinge unit are these:

(1) Settling tank installations may be made in limited space (as opposed to the circular type clarifier).
(2) Maximum use of common wall construction is possible, when there are two or more tanks involved.
(3) A single Clarifier mechanism can operate over two adjacent settling tanks (duplex arrangement) reducing equipment cost.
(4) Clarifier equipment cost does *not* increase with tank length.
(5) All essential working parts are above liquid level.

Hardinge has installed more than 80 Rectangular Clarifier units for municipal sewage treatment, industrial water treatment, and for liquid wastes at paper plants, textile mills, and oil refineries—processing in excess of 350 million gallons of liquid daily.

Write for Bulletin 35-D-64

A Hardinge 57'–10" Duplex Rectangular Clarifier operating over two 150' tanks in a refinery waste water disposal plant.

30' wide by 120' long Hardinge Rectangular Clarifier in a sewage treating plant. Skimmer in raised position.

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COMPANY, INCORPORATED

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ment study of the Mississippi River is expected during the first quarter of 1960. Report by Horner and Shifrin, consulting engineers, is the fact finding phase of a study to form an accurate base for development of design criteria for necessary interceptors and sewage treatment plants.

Horner and Shifrin has made exhaustive studies of sources, types, and volume of sewage entering the Mississippi River from the St. Louis area. This information will form the basis of design for interceptors and treatment plants. Second stage of the study will be shared with Havens and Emerson, specialists in treatment plant design. Third phase of the study will deal with sludge disposal.

The current program ties into agreements developed by MSD, U.S. Public Health Service, and State Water Pollution Board under which a bond issue will be held after study is completed, with the aim of having the complete treatment system in active operation by 1967.

Dividend Declared

The board of directors of Lockwood, Kessler & Bartlett, Inc., Syosset, New York, has voted a quarterly dividend of 10 cents a share on the Class A common stock, payable March 1, 1960, to stockholders of record at the close of business, February 15, 1960. An international engineering organization with operations in the U.S., Canada, and Latin America, Lockwood, Kessler & Bartlett is one of the few professional firms of its type with publicly-owned stock. It specializes in photogrammetry for land surveys and other advanced engineering techniques.

Short Course on Aquatic Biology

"Aquatic Biology for Engineers," a course for sanitary engineers, sanitary chemists, and others engaged in water pollution and control work, will be presented June 20—July 1 by Water Supply and Pollu-

Everything's Up-to-Date...

In Kansas City, the vast redevelopment program that's rapidly changing the face of the city has a special meaning for its railroads and electric utilities. Satisfying today's requirements while readying for tomorrow's increased needs takes precision planning in these key industries.

Kansas City has come a long way since its cow town days, but cattle is still King. Holding up the throne have been dependable railroad transportation and power. And in *railroading* and *electric utilities*—as in all industry—Kerite Cable has been a standard of dependability for many years. *Likewise, when tomorrow's problems occur—Kerite will already be ahead of them.*

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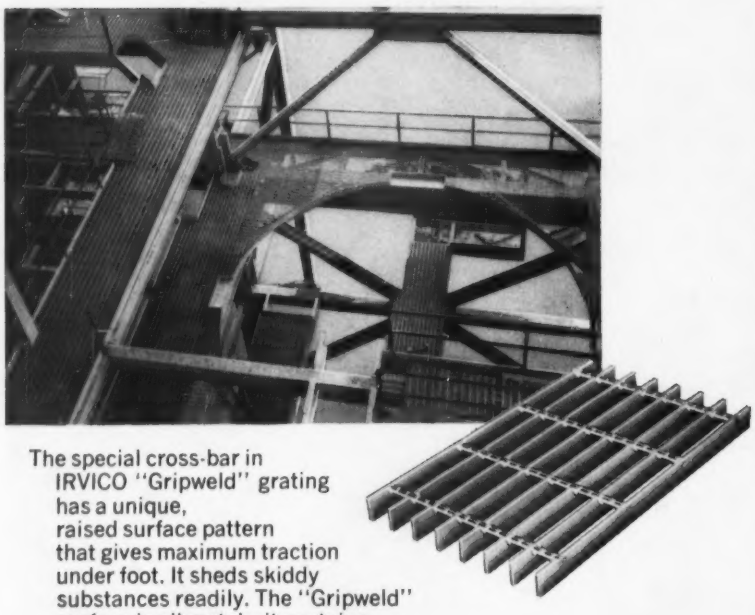
means

- Extra Safety Under Foot
- Strongest, Most Durable Weld
- Quality at a Low Cost



The special cross-bar in IRVICO "Gripweld" grating has a unique, raised surface pattern that gives maximum traction under foot. It sheds skiddy substances readily. The "Gripweld" surface is all metal—it contains no sandy or gritty material that may become dangerously packed with oil or grease.

The cross-bar, especially designed, provides the strongest possible weld to the deep load-bearing bars. Modern fabrication, by simultaneous application of hydraulic pressure and electric current, makes "Gripweld" a rigid, one-piece grating that is remarkably strong and durable, yet low in cost.

When you need grating, especially suited for use wherever surefooted safety is required, choose IRVICO "Gripweld."

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tion Control Training, Robert A. Taft Sanitary Engineering Center, USPHS, Cincinnati, Ohio. Biologists new to the field of water pollution and control may find the course useful for orientation.

Fundamentals of the application of biology to analysis of water pollution problems will be stressed. Laboratory work will feature techniques for handling and identifying aquatic organisms and interpreting their significance. Evaluation of toxic wastes by fish bioassays, and practice in field collections, will be on the agenda.

Applications should be addressed to Chief, Training Program, Robert A. Taft Sanitary Engineering Center, 4676 Columbia Parkway, Cincinnati, Ohio, or to a Public Health Service Regional Office Director.

Los Angeles Rapid Transit

Gibbs & Hill, Inc. will furnish consulting engineering services to Daniel, Mann, Johnson & Mendenhall, Architects & Engineers, of Los Angeles, California, in connection with development of the initial portion of Los Angeles Metropolitan Transit Authority's Rapid Transit Program.

Services required will include a review of the various types of mass rapid transit systems; establishment of information to be furnished by proponents of each system and design criteria as they affect system choice; and recommendations with respect to power supply, distribution, propulsion, signal and communication systems, and automatic train operation.

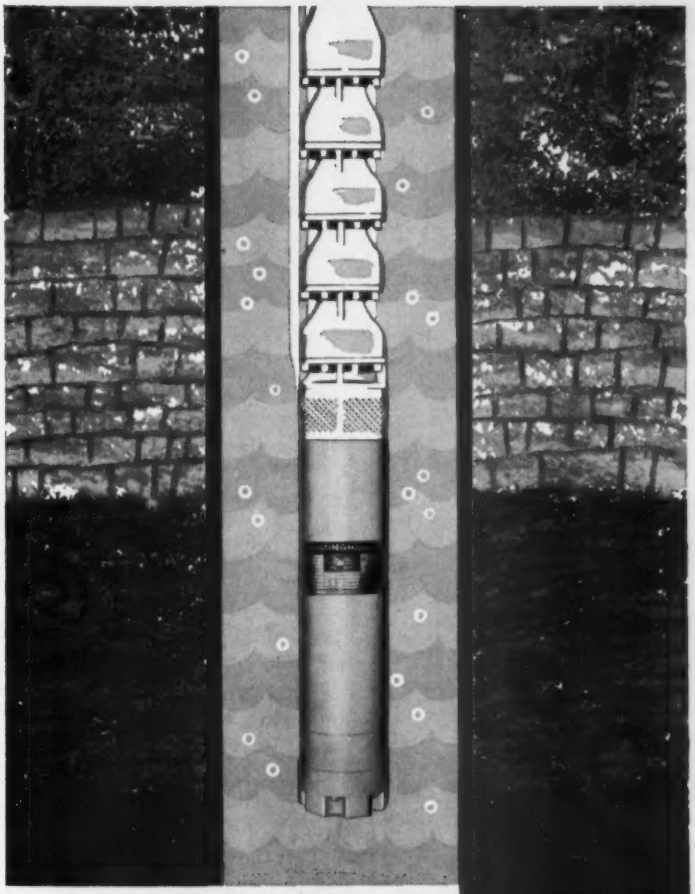
Will Continue Use of Consultants

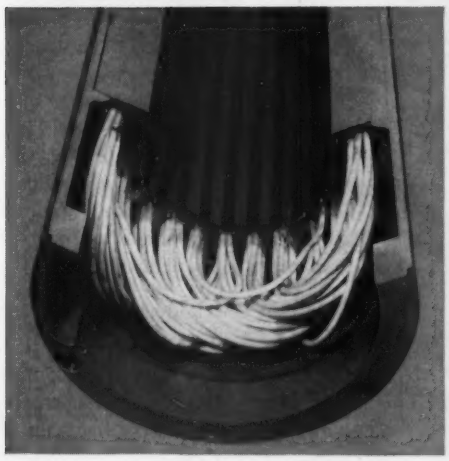
Although noting it has increased the amount of highway engineering work done by its own staff, the New York State Public Works Department disclosed it is continuing to rely primarily on the services of outside consultants.

A department spokesman said that of the $970 million in design work under way at the start of this year, department engineers were

Another new development using

B.F.Goodrich Chemical *raw materials*





Submersible pump motors are manufactured by Westinghouse Electric Corporation, Sunnyvale, California, using waterproof wire insulation made of Geon by Sequoia Wire & Cable Company, Redwood City, California. B.F.Goodrich Chemical Company supplies the Geon vinyl.

Problem of motor submersion solved with Geon insulation

This new motor operates under water using the water itself as a lubricant. Since the housing is water filled and "breathes" well water, its operation depends on the insulation of Geon.

Geon met tough requirements. The manufacturer says that many materials were tested to find one that would stay waterproof indefinitely and also have enough mechanical strength to stand up under the winding process and under flexing imposed in starting.

A test motor was submerged under 400 feet of head for six months and subjected to frequent starting and operation. At the end of the test, the Geon insulation showed no signs of deterioration. Geon also eliminates need for thick and dense coatings over end turns—eliminating a cause of trapped heat and premature failure.

Here's another example of the way that Geon vinyls open new markets, or improve present applications. For more information, write Dept. GI-2, B.F.Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

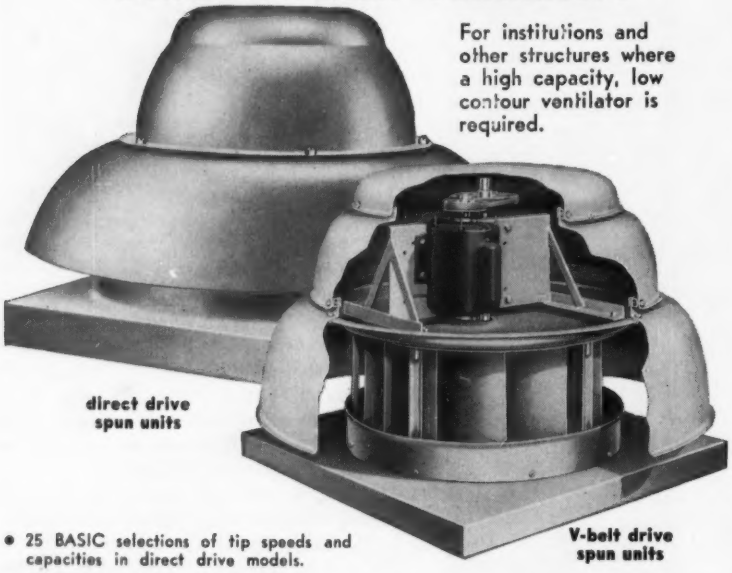
Geon VINYLS

B.F.Goodrich Chemical Company
a division of The B.F.Goodrich Company

B.F.Goodrich

GEON vinyls • HYCAR rubber and latex • GOOD-RITE chemicals and plasticizers

NEW Burt *Spun Aluminum* Direct and V-Belt Drive Centriflow Fan Ventilators



For institutions and other structures where a high capacity, low contour ventilator is required.

direct drive spun units

V-belt drive spun units

- 25 BASIC selections of tip speeds and capacities in direct drive models.
- 64 BASIC selections of tip speeds and capacities in V-belt drive models.
- CAPACITIES from 65 to 27,648 CFM.
- HORSEPOWER ratings from 1/60 to 7 1/2.
- SIZES from 6" through 48" wheel diameters.
- STATIC PRESSURE range from 0" through 1" W.G. (higher static pressures on application).
- LOW PROFILE heavy gauge spun aluminum housings.
- NON-OVERLOADING backward curved, non-sparking aluminum fan wheels.
- ADJUSTABLE SHEAVES on V-belt units to change capacities at anytime.
- DAMPERS available in drop-in sleeve type, automatic back-draft or motor operated.
- BURT DESIGNED for minimum noise levels.
- AMCA CERTIFIED capacity ratings for units of 16" wheel diameter and larger.

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handling 28 percent. Department engineers at the start of last year were working on 21 percent of the $760 million in design work in progress at that time.

In revealing that the department plans to continue retaining consultants for designing major projects, the spokesman pointed out to the press that such work would tie up much of the department's engineering personnel and force other highway improvement projects in the state to be neglected.

New Sewage Disposal Method

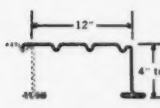
Royalty-free access to new scientific methods of sewage disposal was recently offered to Canadian municipalities by Resources Minister Hamilton. The new technique was developed and patented by the Pulp and Paper Research Institute of Canada. In making the announcement of a royalty-free offer to government agencies of all levels, the Minister was joined by Chairman F. L. Allen of the Pulp and Paper Research Institute.

"For many years now," Hamilton stated, "Canada's pulp and paper industry, McGill University, and the Government of Canada have carried on valuable research through the Institute in order to support the world competitive position of Canada's prime industry. I am grateful that the directors of the Institute should have unanimously agreed that any government in Canada – be it municipal, provincial, or federal – should receive the royalty-free use of this new technique for sewage disposal in recognition of the Federal Government's practical support of reesarch in the Institute."

Pollution Crackdown in Ohio

A crackdown was ordered by the Ohio State Water Pollution Control Board on cities and villages apparently stalling on construction of adequate sewage treatment plants to prevent pollution of state waters. Dr. Ralph E. Dwork, state health director and chairman of the five-

INLAND coordinated roof systems save school building dollars

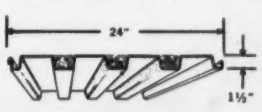


T-STEEL — New! Galvanized. For clear spans to 32'0". Adaptable to acoustical and flush, luminous treatments. Provides superior diaphragm to resist seismic and wind loads.

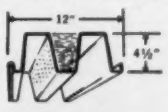
Ceiling Treatments with T-Steel Deck

Standard Tile or Board — Light Diffuser

Surface-mounted Fixture — Lath-and-Plaster Fireproofing



TYPE B ACOUSTIDECK—For purlin spacings to 10'. Uses minimum of 1" rigid insulation board.



TYPE C ACOUSTIDECK—For purlin spacings to 24'0". Uses minimum of 1½" rigid insulation board.

EP-6A

...Complete structural systems permit a range of ceiling, lighting, and acoustical treatments within budget limitations

Acoustideck serves as a combination steel roof deck and acoustical ceiling with a Noise Reduction Coefficient of .70. It is especially practical over gyms and other activity areas.

Panels are erected fast in any weather that a man can work. Since the panels are Bonderized, then covered with a baked-enamel prime finish, field-painting costs can be cut in half because only one finish coat is required normally. The fluted underside is left exposed as an attractive ceiling.

New T-Steel Roof Deck allows you design freedom in covering classrooms of 26' to 32' spans. You can specify various types of acoustical tile — provide a flush, luminous ceiling — or leave the underside of T-Steel exposed and paint it. You provide a superior diaphragm to resist seismic and wind thrusts.

Write for catalogs 240, 241, and 246 — or see Sweet's, sections 2c/Inl and 11a/In. For help on unusual problems, you can draw on the diversified experience of Inland sales engineers. Write or call your nearest Inland office.

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ENGINEERED PRODUCTS DIVISION

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member board, declared, "All indications are that the board has exhausted its patience with these cities." His comment came after the board defeated a motion to give Youngstown a 60-day extension on an order to clear up the pollution situation in that city. Dr. Dwork said the board thus indicated it is ready to cut off "stays of execution" to lagging municipalities "unless they have a special meritorious argument." The board also denied a motion to grant Youngstown a sewage-dumping permit. In such cases, the city has 15 days in which to make its appeal to the courts.

In Ohio, 72 villages dump raw sewage into open water. Twenty-one of these villages are building treatment plants and the board is following up on the other 51. Of 14 cities dumping raw sewage, seven are building plants and six are in the process of starting construction work. Bellevue, in Sandusky County, dumps sewage into underground limestone caverns. Wellston is seeking Federal aid for its plant, and Yellow Springs is involved in a controversy over running a sewer main through the Antioch College campus.

New Cities Planned

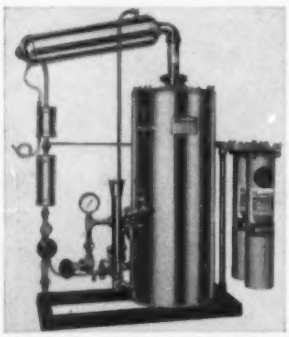
Tucson and Chicago investor-builders have announced plans for a new city for 1.5 million people on a 107,000-acre tract on the outskirts of El Paso, Texas, to be named Horizon City. Its backers will start construction this summer. El Paso itself has a current population of about 150,000.

Plans for a city of 30,000 people on a 7000-acre ranch in Orange County, near Los Angeles, have been announced by a Boston property management company. Projections call for several thousand homes, two golf courses, three lakes, five parks, five shopping centers, and a downtown area complete with retail, medical, office, and administration facilities to serve the entire development.

Indiana Toll Road Spur

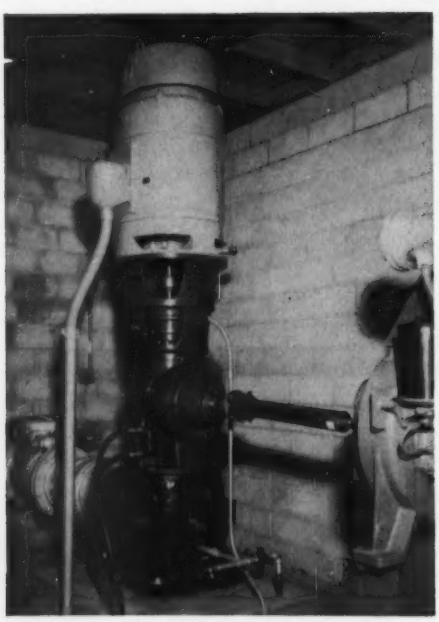
Construction of a spur of the Northern Indiana Toll Road to connect with Interstate 94 in Michigan was proposed to the Indiana Toll Road Commission. Action on the spur was deferred on grounds that the point at which Interstate 94 will leave Michigan and enter Indiana is unknown.

Consideration of the toll spur was urged by Wilbur Smith and Associates, the commission's traffic engineering consultants. The firm, in a report to the commission, said a study of the question should cover traffic and revenue potential and costs for connecting the La-Porte interchange with the Michigan highway. It recommended that the survey be undertaken at an early date because of the need to serve traffic which otherwise funnels into US 12 across the northern part of the state. ▲▲



PUREST DISTILLED WATER FROM THE STILL YOU NEVER HAVE TO CLEAN

Stops scale, hard deposits, and sludge formation. Neither boiler nor coil will ever require scale removal or scraping. Feedback Purifier eliminates amines and other boiler treatment compounds and final distillation removes bacteria, pyrogens, organic matter etc. Write for Bulletin 145-A. Barnstead Still & Sterilizer Co., 57 Lanesville Terrace, Boston 31, Mass.



NEW! Automatic combination gear drive

JOHNSON

***Redi-Torq*®**

Redi-Torq combination right angle gear drive with automatic clutch, eliminates manual switch-over to engine drive in case of power failure. Drive couples to engine by flexible shafting or couplings—engine clutch unnecessary. Engine may be tested without interfering with electric motor operation of pump.

For round-the-clock protection against power failure in water, sewage and fire installations. Developed and proven in municipal and industrial use over several years.

Sizes: 15 to 200 hp; hollow or solid shafts. Write for engineering catalogs.

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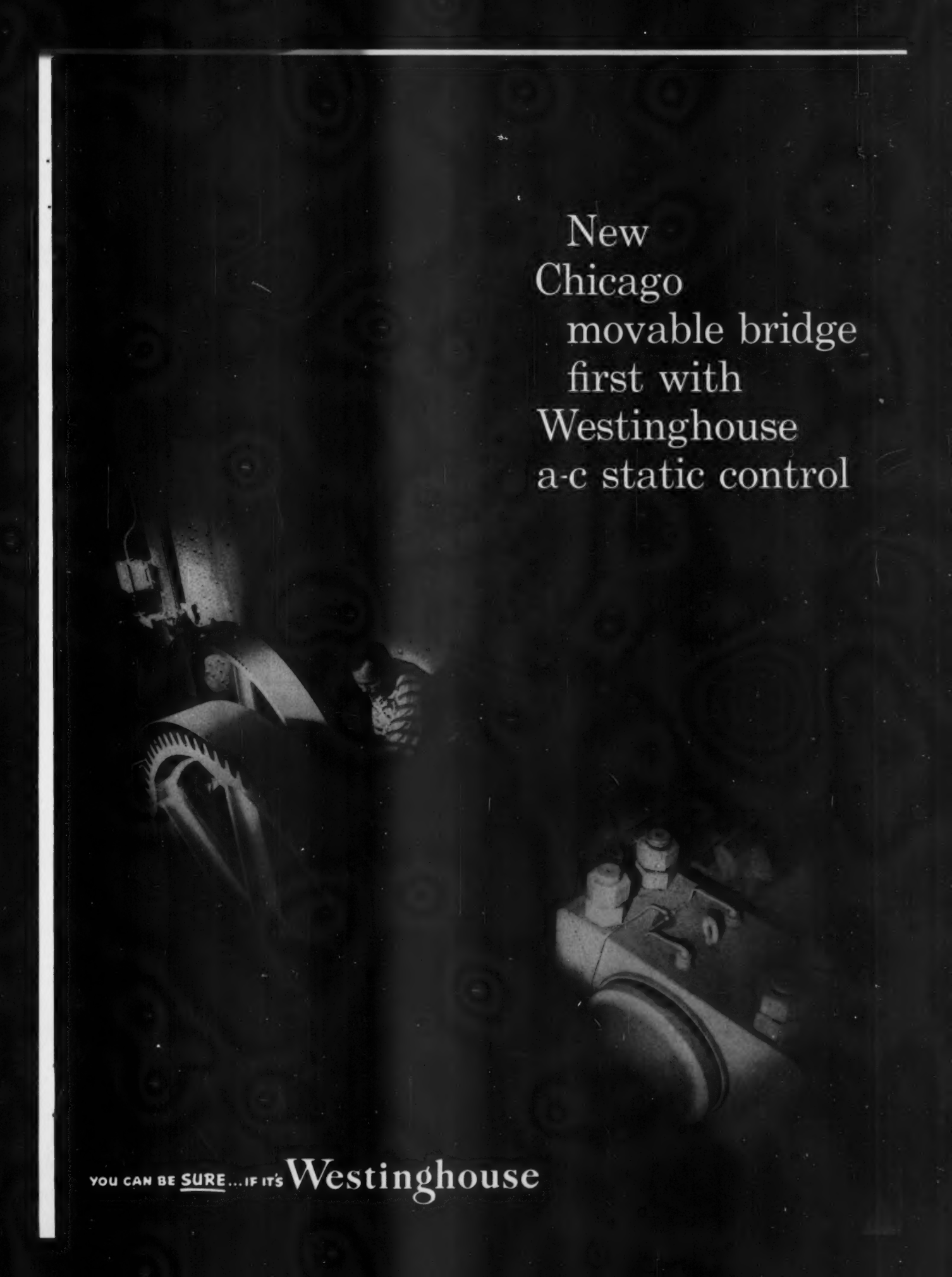

New
Chicago
movable bridge
first with
Westinghouse
a-c static control
YOU CAN BE SURE ... IF IT'S Westinghouse

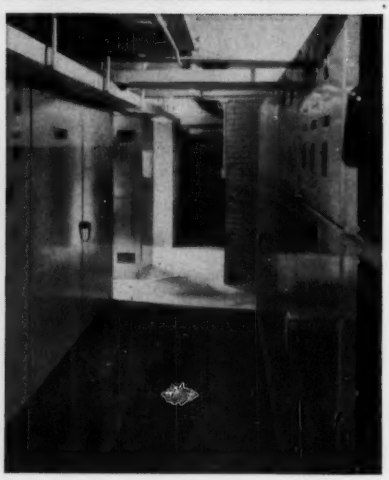
COVER PHOTO: View at West Van Buren Street Bridge, Chicago, showing leaf rack, pinion and main drive gearing operated by Westinghouse Bridg-O-Matic control to raise and lower east leaf of bridge.

Double leaf, trunnion bascule bridge opening for Chicago River traffic. One man in operator's room, East Pier, upper right, controls the bridge by means of an all a-c system employing Westinghouse saturable reactor-type controller.

J-94132-2

W. C. Carl, Construction Engineer, Westinghouse (standing), discusses Bridg-O-Matic drive with Stephen J. Michuda, Chief Bridge Engineer, City of Chicago, at right, and his staff (left to right): S. Frayer, Structural Engineer; M. D. Krausman, Assistant Chief Bridge Engineer; and R. H. Keil, Electrical Engineer, Bridge Division.

Stephen J. Michuda; M. B. Trimble, Construction Sales Engineer, Westinghouse; and William G. Divane, President, Divane Brothers Electric Company, Electrical Contractors, discuss main control desk which centralizes operation of leaf and auxiliary drives and selection of east and west incoming service feeders. Instruments on sloped panel indicate leaf position and electrical circuit conditions.



View of switchboard room showing incoming line switching equipment, magnetic control for auxiliary drives, Bridg-O-Matic wound rotor motor control panels and saturable reactor cubicles. Robert E. O'Brien, Chief Electrician, examines panel containing emergency control switching equipment at far end of room.

Westinghouse Bridg-O-Matic Control specified to operate Chicago's West Van Buren Street Bridge

An important factor in the design of the West Van Buren Street movable bridge in Chicago was the selection of the most efficient drive and control system available. Westinghouse Bridg-O-Matic* control was specified after a study of its advantages over other types of control.

The West Van Buren Street Bridge is a double leaf, trunnion bascule bridge across the south branch of the Chicago River and is designed to carry vehicular and pedestrian loads. Each bridge leaf is normally operated by two 100-hp a-c wound rotor induction motors. For emergency operation, a single motor per leaf may be used. During normal operation, the time required to open or close the bridge is approximately 55 seconds. Four electrically operated thrustor brakes are provided for holding each leaf in the desired position. Minimum brake shoe lining wear is encountered since the leaves are normally retarded by the motors through the action of the static reactor/Magamp controller to a low speed before the brakes are caused to set.

The normal control of the two operating motors for each leaf, connected for parallel operation, is by means of the Bridg-O-Matic control (a-c reactor control system). The speed torque performance of this system provides precision operation under all conditions of leaf load from normal to a 10-lb wind, without the use of any "mechanical" braking, for positive slowdown and reduced speed operation.

Electric power, supplied by two independent networks, is three phase, four wire, 60 cycle at 208/120 volts, stepped up at the bridge through transformers to 480 volts.

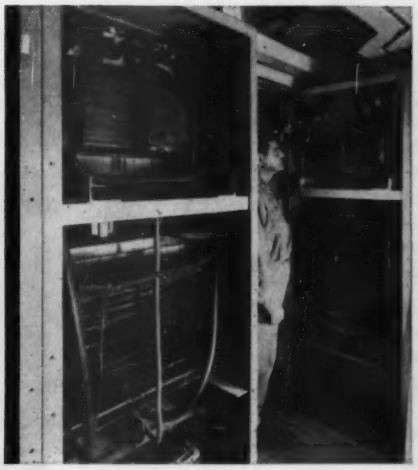
An alternate control system may be selected by moving the control selector switch from "Reactor" to "Off." This provides the conventional reversing wound rotor controller with six power points and a drift point. Either motor may be used. *(contd.)*

*Trade-Mark

J-94132-3

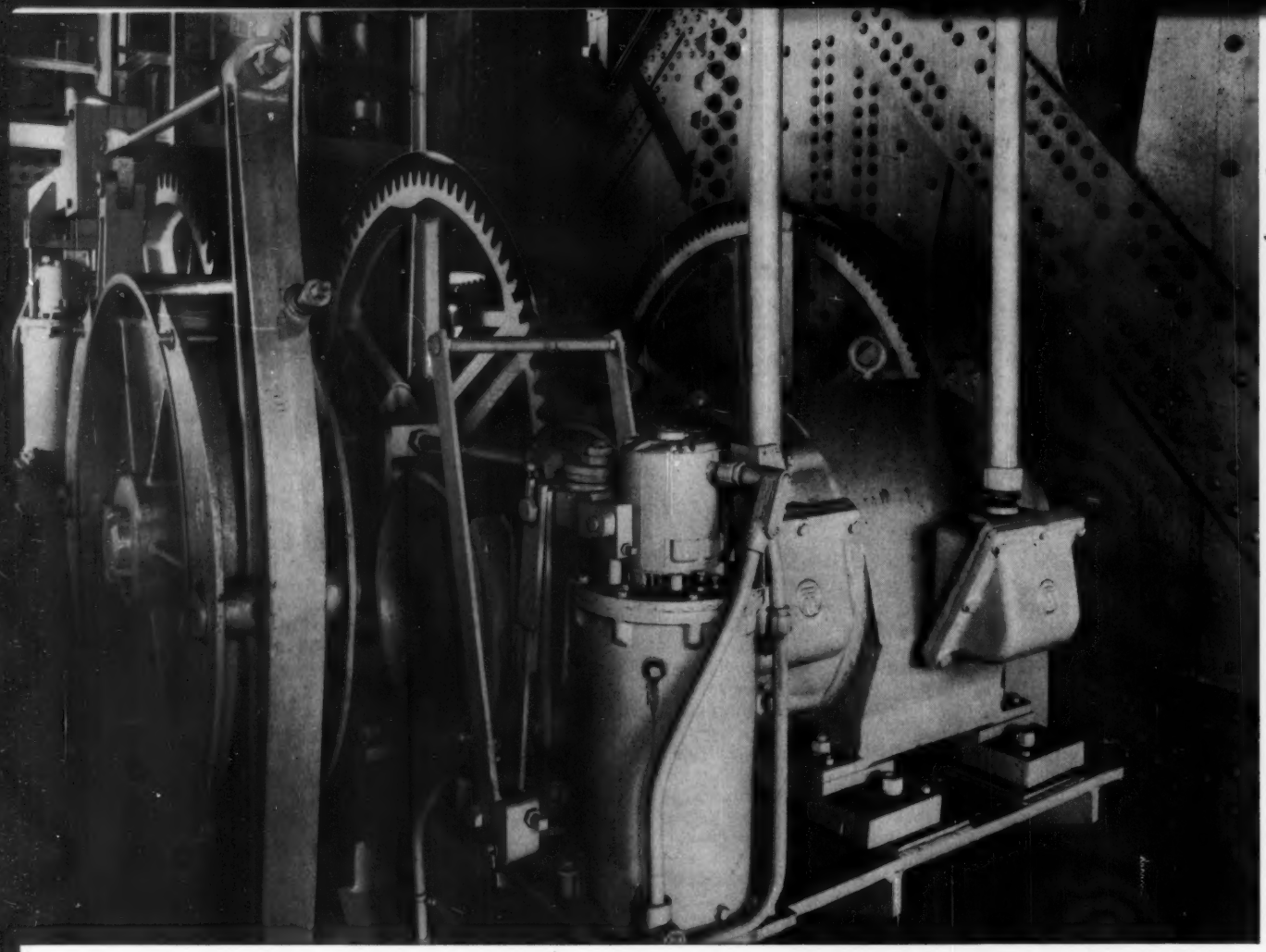
YOU CAN BE SURE...IF IT'S
Westinghouse

L. A. Johnson, Westinghouse Sales Engineer; E. A. Leske, Electrical Engineer, Divane Brothers Electric Company; and R. H. Keil inspect Westinghouse Magamp control section of bridge switchboard.



Chief Electrician, Robert E. O'Brien, checks cubicles which house Westinghouse primary saturable reactors.

Incoming line cubicle of bridge control (switchboard room, East Pier) is inspected by W. C. Carl; Edward Klausner, Engineer in Charge of Bridge Construction; and R. H. Keil.



View showing one of leaf drives (there are two per leaf), each with Westinghouse 100-hp a-c wound rotor motor and a-c thrustor-operated motor and machinery brakes.

Westinghouse Bridg-O-Matic operates Van Buren Street Bridge (contd.)

Interlocks are provided in the control system to prevent operation of leaves until all flashers, traffic lights, gongs and warning horns are operating, traffic gates are down, and bridge centerlocks are withdrawn.

Westinghouse saturable reactor a-c systems offer many possibilities for vertical lift, bascule or swing bridge designs, and other applications such as dam and lock gates, cranes, hoists, etc. For more information call your Westinghouse electrical construction engineer, or write: Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pa. J-94132-4

OWNER & DESIGNER: City of Chicago, Ill.
Department of Public Works, Bureau of Engineering
Division of Bridges and Viaducts

CONSULTING ENGINEER: Hazelet & Erdal, Louisville, Ky., and Chicago, Ill.

ELECTRICAL CONTRACTOR: Divane Brothers Electric Company, Chicago, Ill.

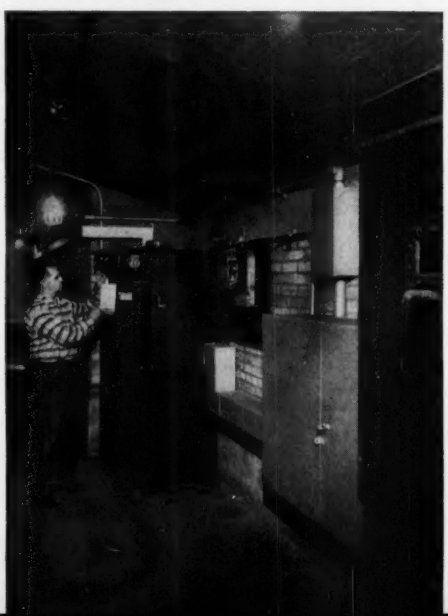
SUPERSTRUCTURE-MACHINERY CONTRACTOR:
Overland Construction Company, Chicago, Ill.

STEEL FABRICATOR: American Bridge Division, United States Steel Corporation, Pittsburgh, Pa.

YOU CAN BE SURE...IF IT'S Westinghouse

WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS" CBS TV ALTERNATE FRIDAYS

John A. Machiels, Bridge Maintenance Machinist, looks at the 225-kva Westinghouse Inerteen®-filled step-up transformer which provides 480-volt supply for bridge drive motors and auxiliaries. Type DB-50 wall-mounted circuit breaker provides main feeder protection.



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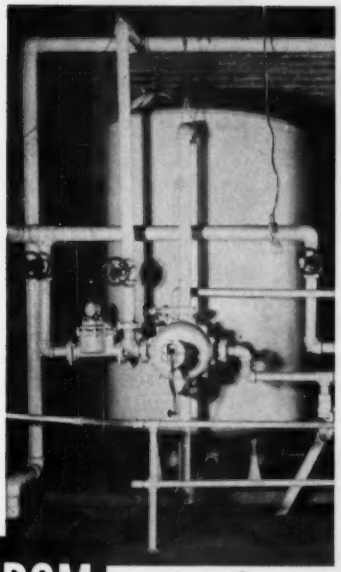

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The Elgin installations above are poles apart—in form, in purpose, in cost. But they have one thing in common: Thanks to Elgin know-how, they are the best of their kind. And so is "everything in between" when it's Elgin!

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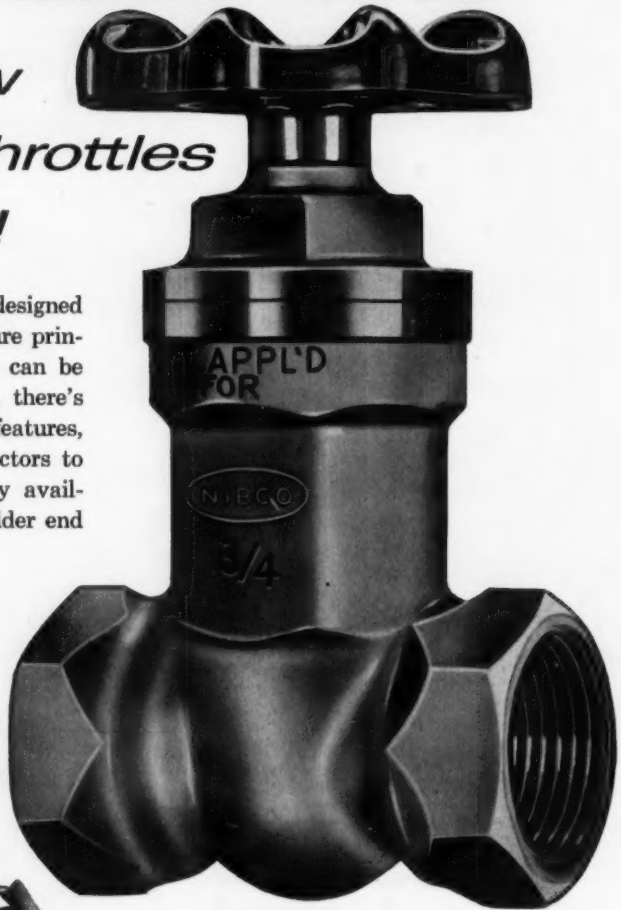

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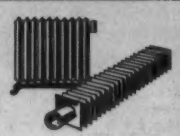
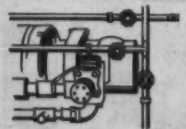

Radiators

Water Pumps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Men in Engineering

Harry Ellsberg, chief structural engineer, Giffels and Rossetti, Detroit, recently received the 1959 Concrete Achievement Award, sponsored by Huron Portland Cement Company on behalf of the Concrete Improvement Board of Metropolitan Detroit. The award, in the form of an engraved plaque, was presented to Ellsberg for his efforts in promoting specifications and quality concrete in various projects, including such prominent Detroit structures as Cobo Hall and the new U.S. Post Office.

At the annual meeting of stockholders of J. E. Sirrine Company, Engineers of Greenville, South Carolina, three new members were elected to the board of directors. They are: Fred M. Martin, John L. Roberson, and C. T. Wise. Other action included the re-election of the following officers: chairman of the board, R. R. Adams; president, George Wrigley, Jr; treasurer, John L. Roberson, Jr; and secretary, A. D. Asbury.

Jack N. Steketee, of Samborn, Steketee & Associates, Otis & Evans, Toledo engineers and architects, has been recommended by the Toledo Section, American Society of Civil Engineers for the 1960 Ernest E. Howard National Award for utilizing a new construction technique in building "Crestview," the 171-unit apartment for retired people recently completed in Sylvania, Ohio. According to the firm, the new method, known as the "two-way voided lift slab" technique, results in considerable savings in over-all construction costs.

The Ernest E. Howard Award, established in 1954, is given annually to an ASCE member who has made a definite contribution to the advancement of structural engineering. In 1959, the Award was presented to David B. Steinman for the design of the Mackinac Bridge.

Formation of the consulting engineering firm of Emil F. Vranich and Associates, Inc. has been announced. The firm will practice at 625 N. Milwaukee Street, rendering consulting services to architects and industry throughout the Milwaukee and Wisconsin areas. The firm specializes in building design, foundation engineering, supervision of construction, and general civil engineering services. Vranich formerly held the position of president of Collings-Vranich and Associates, Inc., which has terminated its practice.

Announcement has been made of the realignment of administrative responsibilities in the mechanical division of Albert Kahn Associated Architects & Engineers, Detroit. Saul Saulson, a vice president in the firm, has relinquished the duties of chief mechanical engineer, which he has discharged for more than 40 years, to devote his efforts and engineering experience to his position of director of mechanical engineering. Saulson will be responsible for the advance analysis of all projects with respect to mechanical requirements and projected suitable mechanical engineering designs.

G. S. Whittaker, a vice president and director of the firm, has been named chief of the mechanical division and assumes full responsibility for its operation and administration. Whittaker has been in charge of the heating department since 1931 and for the past two years served as assistant to Saulson.

Other promotions in the mechanical division include: Charles Allen, chief-heating engineering; Homer Yaryan, chief-plumbing engineering; Norton Taylor, assistant chief-ventilating and air conditioning engineering. All three are registered engineers and are associates in the Kahn organization.

WHITTAKER LASCHOBER

Joseph Laschober, nationally known Los Angeles food facilities consultant and author, has formed a new consulting engineering firm to be known as Joseph Laschober and Associates, Inc. Laschober, president of the new firm, formerly was principal associate of Fred Schmid Associates, food service designers and head of the commercial kitchen design section of Welton Becket & Associates. Offices of the new firm are located at 2304 Huntington Drive, San Marino, California.

Burns and Roe, Inc., New York City architect-engineering firm, has established a wholly-owned subsidiary, Burns and Roe Western Hemisphere Corporation. Incorporated under the laws of the State of Delaware, the new cor-

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...the most *practical* method of luminaire maintenance!

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poration will undertake engineering and construction projects in North, Central, and South America as well as the West Indies, but not those in the continental United States. The latter will continue to be handled by the parent company.

Officers of Burns and Roe Western Hemisphere Corporation are Ralph C. Roe, president; Kenneth A. Roe, executive vice president; Edmund M. Kowkabany and Melbourne A. Forrest, vice presidents; Miss Jeanette Laurencelle, secretary; Carl H. McKenzie, treasurer; and Judson G. Hyde, controller. The first four men and Hyde also are directors of the corporation.

Wikle & Einik, Engineers, Los Angeles, has changed its name to Einik Engineers & Associates. The firm address remains at 11941 Wilshire Boulevard.

Consoer, Townsend and Associates, Chicago consulting engineers, has opened a branch office in Silver Spring, Maryland. Fred N. Van Kirk has been named manager of the new branch office.

Ralph A. Larsen has been appointed chief design engineer of Stone & Webster Engineering Corporation, succeeding Charles D. Lilburn who has been named design consultant. In his new position, Larsen is responsible for the design and drafting work of more than 400 men and women in the design division.

In another action at Stone & Webster, George W. Letteney has been appointed assistant treasurer.

Sterling F. Smith, P.E., executive vice president of Consultants, Inc., Washington consulting engineering firm, has been selected by the Department of Commerce to supervise the writing of an economic report and long range market projection study on the refrigeration, air conditioning, and related industries. Smith was retained by the General Industrial Equipment Di-

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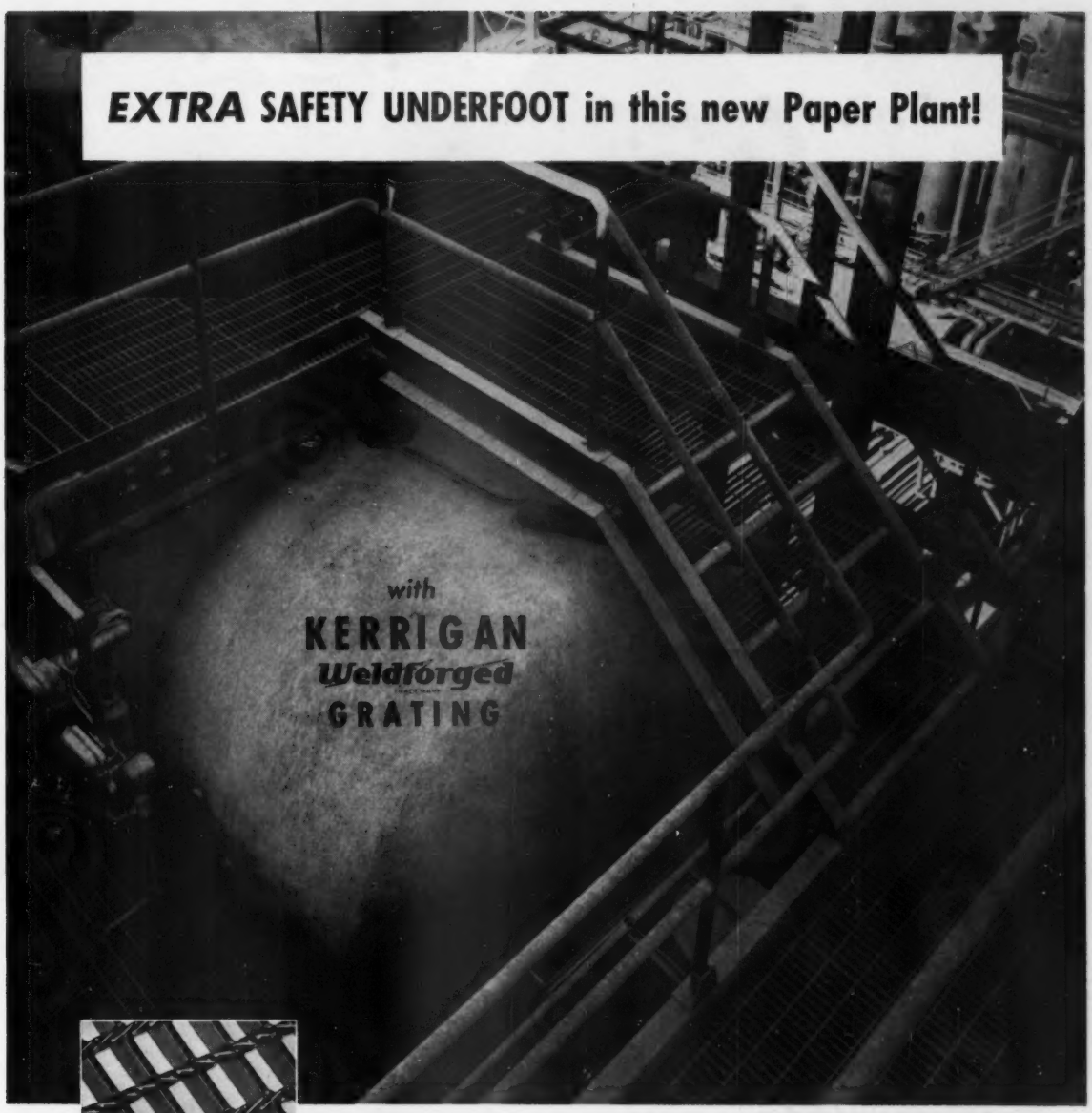

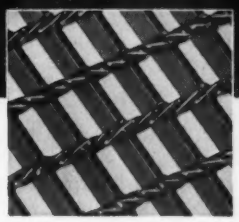

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Extra durability is a *bonus* you get along with many other proved advantages of Kinnear Rolling Doors.

Striking new proof of this was recently added to Kinnear's records of remarkably long door service: A whole battery of Kinnear Doors with 50 years of service in a busy shipping terminal *were removed from the old building for continued use in the modern structure that replaced it!*

That's why it's important to you that every Kinnear Door is *Registered*. Detailed drawings of each door are kept permanently in Kinnear's own fireproof vaults.

This is a Kinnear service that started before the turn of the century (when Kinnear *originated* the door with the interlocking-slat curtain).

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In addition, Kinnear Rolling Doors save space . . . coil completely out of the way . . . clear the entire opening . . . remain out of reach of damage while opened . . . complement any building architecture . . . and assure all-metal protection against wind, weather, trespass or vandalism. Built to fit any opening, in new or old buildings. Power operated if desired. *Write for full details!*

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vision of the Commerce Department to set up and guide the project because of his unique experience in the fields of management, marketing, and engineering. Smith's previous administrative experience in government also contributed to the well rounded background that was considered necessary for the guidance and management of the project.

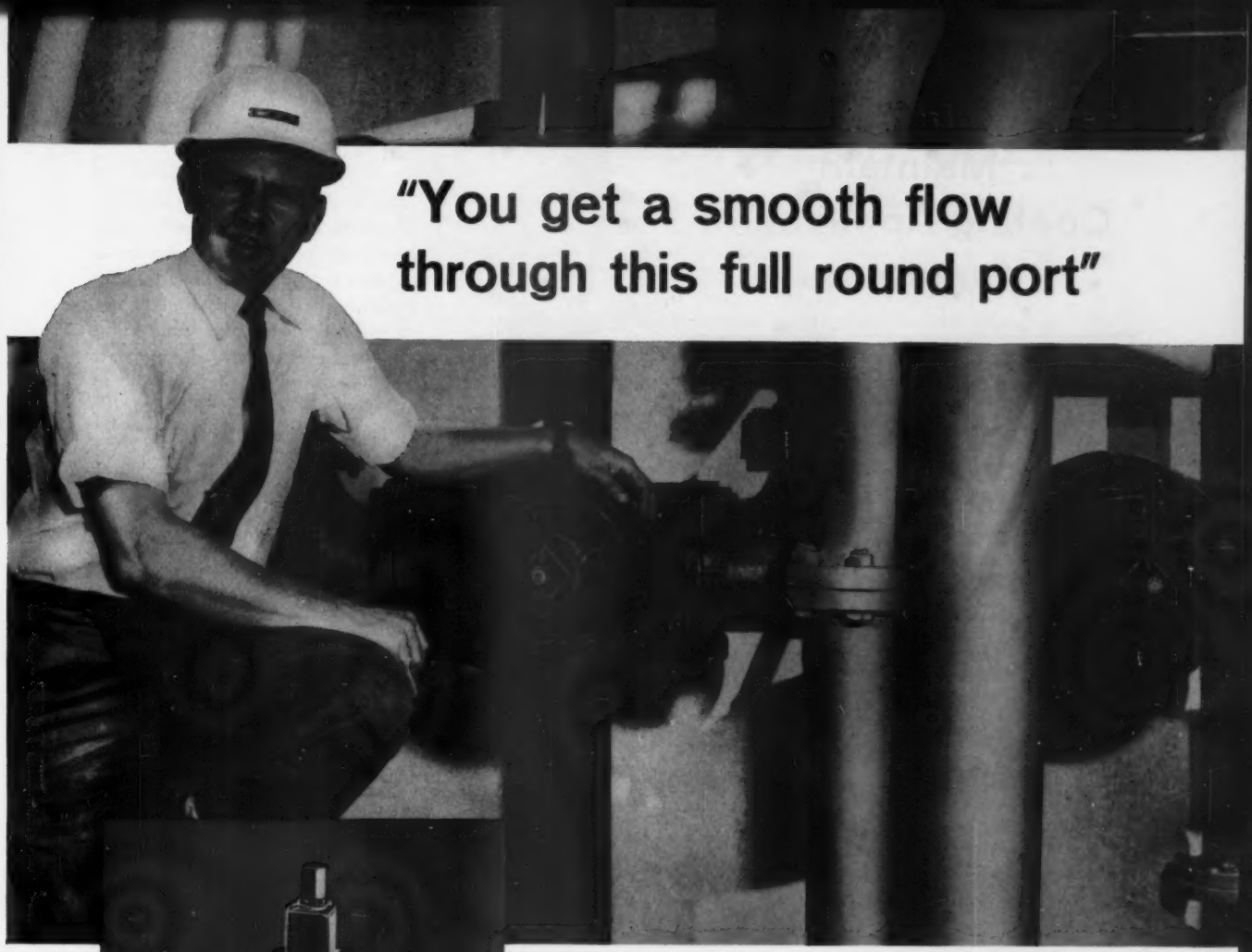
Walter G. Edwards, executive vice president of Marc Shiowitz and Associates, Inc., Hawthorne, California, has been elected to the board of directors of this computer consulting firm. In addition to consulting with the company's clients on computer circuits, Edwards' responsibilities include maintenance of professional quality control on MS&A's design projects.

Wesson H. Miller has joined the staff of The Benjamin E. Beavin Company, Baltimore consulting engineers. Miller came to the Beavin Company from Baker-Wibberley & Associates where he was in responsible charge of design of a number of important highway bridges and interchanges.

John R. Kemp, formerly with the Minnesota Department of Highways, has been appointed chief engineer of Lindsey Engineering Company, Minneapolis, Minnesota.

Anthony Mauriello, P.E. has joined Engineers Incorporated, consulting engineers of Newark, New Jersey, as engineering administrator. In this newly created position, Mauriello will be responsible for over-all project scheduling and coordination. Previous to joining Engineers Incorporated, Mauriello held many engineering and administrative positions in industry and government as well as with other consulting organizations.

Harold M. Bennett also has joined the firm, as a project engineer specializing in heating, air conditioning, and ventilating de-



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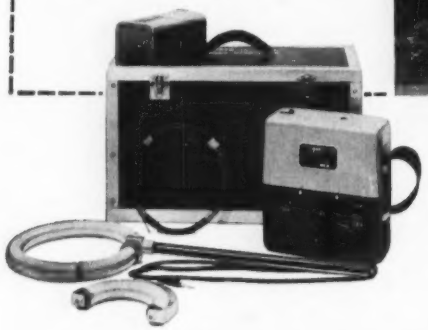
INSPECT WITH A TR HOLIDAY DETECTOR!



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Every holiday in your protective coating increases the current requirements of cathodic protection. The result is constantly increasing maintenance costs.

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sign. Bennett formerly was chief mechanical engineer of Fellheimer and Wagner in New York.

John T. Pinkston and Robert R. Wagstaff have been elected vice presidents of United Engineers & Constructors Inc., Philadelphia. Pinkston also will retain his responsibility as process consultant, the post to which he was appointed when he joined United Engineers in 1959, and will be in charge of all process development activity for the firm. He also will be in charge of the firm's activities in the gas industry. Prior to joining United Engineers, Pinkston was manager

PINKSTON WAGSTAFF

of process at Catalytic Construction Company, Philadelphia.

Wagstaff also was named a director of the firm. He has been with United Engineers since 1937 when he joined the firm as an electrical field engineer.

Arrowhead Engineers, Inc., consulting-architect-engineers, of Denver, Colorado, announce the opening of a New Mexico branch office in Albuquerque, located at 1025 Hermosa Drive, S.E. Head of the new office is Dr. Eugene Zwoyer, a registered professional engineer.

The firm of Evans, Michaud, Cooley, Hallberg & Erickson has been organized to continue the consulting engineering practice formerly conducted under the name of Richard W. Evans & Associates. Principals of the new firm are Richard W. Evans, president and treasurer; Robert L. Michaud and Sherman

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Greensboro: Elec. Sup. & Equip. Co.
Kinston: Kinston Elec.
Winston Salem: Noland Co.

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Sylvan Elec. Fix. Co.
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Argo Lite Studios
Brown & Green
Wally Elec. Sup. Co.
Reading: Coleman Elec. Co.
Scranton: Lewis & Reif, Inc.
Uniontown: Pioneer Electric Dist.
Wilkes Barre: Anthracite Elec.

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Providence: Leavitt Colson Co.

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Nashville: Nashville Elec. Sup. Co.

TEXAS
Dallas: Rogers Elec. Sup. Co.
Ft. Worth: Anderson Fixture Co.
Cummins Supply Co.
Houston: Gross Electric Supply
Warlin Associates
Southern Electric Supply Co
San Antonio: Southern Equip. Co.
Strauss-Frank Co.

UTAH
Salt Lake City: Artistic Lighting

VIRGINIA
Arlington: Dominion Elec. Sup. Co. Inc.
Noland Co.
Lynchburg: Mid-State Elec. Sup. Co., Inc.
Norfolk: Noland Co.
Roanoke: Noland Co.

WEST VIRGINIA
Huntington: West Virginia Elec. Co.
Wheeling: The Front Co.

WISCONSIN
Appleton: Moe Northern Co.
Eau Claire: W. H. Hobbs Sup. Co.
La Crosse: W. A. Roosevelt Co.
Milwaukee: Lappin Elec. Co.
Standard Elec. Sup.

WASHINGTON
Seattle: Seattle Lighting Fix. Co.

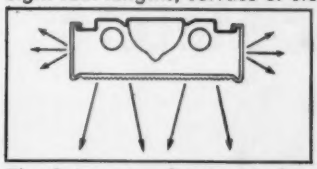
ALASKA
Anchorage: Northern Supply Co.

CANADA
Montreal: L. D. G. Products, Inc.
The Gray Elec. Co.
Union Electric Sup. Ltd.
Quebec City: La Cie Martineau Electric Co
Toronto: Revere Elec. Dist.
Toronto Ltg. Studios

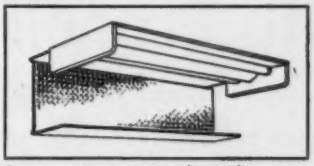
HAWAII
Honolulu: Hawaiian Light & Sup. Co.

The specification: PRISMALUX *by* LIGHTOLIER

NEW—one-piece lens-and-diffuser with low brightness bottom and luminous diffuser sides to provide glare-free illumination and minimum brightness contrast. Coupled with styling that is crisp and clean, construction that is rugged and trouble free—Prismalux is an excellent specification for stores, offices, schools and other critical lighting applications. In two, three and four light widths, four and eight foot lengths, surface or stem mounted.



The fine-textured prismatic lens floods low-brightness illumination downward. The low-brightness diffuser sides send soft light out across ceilings, reduce brightness contrasts.



For maximum rigidity, the combination lens-diffuser is supported along its full length. Safety hinges permit access from either side of lens diffuser, cannot be accidentally dislodged.

To learn more about Prismalux by Lightolier, write today for a complete brochure to Dept. CE-40.

LIGHTOLIER

Jersey City 5, New Jersey

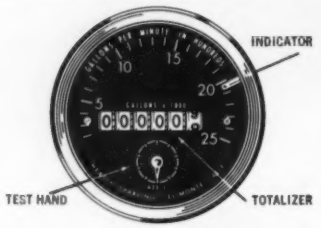
Showrooms: New York, Chicago, Dallas, Los Angeles

SPARLING METERING TOPICS

Direct Totalization at a Glance with Propeller Meters

NO CONVERSION REQUIRED... Direct totalization is the primary function of a propeller meter. Continuous and reliable total flow information is provided instantly, without need of conversion tables or additional instrumentation.

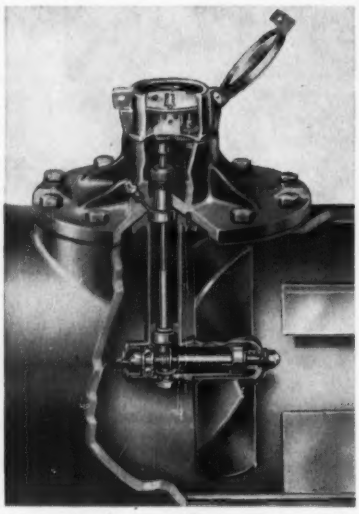
Totalization results from a simple mechanical operation. A propeller suspended in the center of a straight tube is turned by the kinetic energy of the moving liquid and rotates in direct relation to the flow velocity. Through a basic shaft and gear mechanism, the propeller rotation produces the exact volumetric figures on a straight-reading, 6-digit totalizer that may be read directly at the meter itself or transmitted to remote locations.



Where rate of flow as well as direct totalization is desired Sparling provides a combination indicator-totalizer that shows both simultaneously.

ASSURED ACCURACY...When properly installed, propeller meters register within 2% accuracy at all flows within the rated range of the meter. Sparling uses rugged, resilient plastic propellers that hold the precise pitch and set of the blades for the life of the propeller to guarantee continuing accuracy.

INSTALLATION VERSATILITY... Sparling meters can be located at any desired angle and still function with the same accuracy. They may be installed at either pump suction or discharge, and are unaffected by variation in pressures.



Meter head assembly can be readily removed for periodic inspection.

DURABLE... Moving parts in a propeller meter are few. They consist of worm and worm gear, shafts, change gears and bearings. The meters are designed and engineered to maintain exacting tolerances and to operate accurately even after years of continuous wear.

NEGLIGIBLE HEAD LOSS...The straight bore of a Sparling meter tube presents no obstruction, so flow is never distorted or constricted; hence, need for pressure recovery is eliminated. Pressure loss for a standard 8" Sparling meter is less than 3" at normal flows.

WIDE AVAILABILITY...There is a complete range of Sparling propeller meters, instruments and control equipment to meet any main-line metering requirement. Ask your Sparling field representative for further information, or WRITE FOR CATALOG 315CE.

SPARLING WATER CONTROL EQUIPMENT

Hersey-Sparling Meter Company

225 N. Temple City Blvd., El Monte, California

HERSEY PRODUCTS: Dedham, Mass. • SPARLING EQUIPMENT: El Monte, Calif.

Branches in: Atlanta • Chicago • Cleveland • Dallas • Denver • Kansas City, Mo. Roselle, N.J. • San Francisco • Seattle • *United Kingdom Affiliate:* TYLORS OF LONDON, LTD.

J. Cooley, vice presidents; Warren C. Hallberg, secretary; and Robert E. Erickson, assistant secretary. The firm's office will remain at 337 Plymouth Building, Minneapolis.

Frank B. Sarles, consulting civil engineer, Santa Rosa, California, announces that two of his principal engineers, Walter E. Brelje and William B. Race, have been named partners of his firm. The firm name has been changed to Sarles, Brelje and Race but offices remain at 425 South "E" Street.

At the annual meeting of Chas. T. Main, Inc., consulting engineers of Boston, Massachusetts, and Charlotte, North Carolina, C. M. Flint, Van Court M. Hare, and Will J. Lessard were elected directors of the corporation.

Fred S. Dubin Associates, consulting engineers, with offices in New York, Boston, Hartford, St. Louis, and San Juan, announce the appointment of A. Roger Kelly, P.E., as associate and manager of the New York office.

Steve J. Gadler, Col. USAF (Ret.), director of the electronic division of Hitchcock & Estabrook, Inc., consulting engineers and architects, Minneapolis, has been elected a vice president of the firm.

Rear Adm. Joseph F. Jelley, USN (Ret.) has been retained as an engineering consultant by Henningson, Durham & Richardson, consulting engineers, and will make his headquarters in the Colorado Springs, Colorado office at 121 East Vermijo Avenue. Jelley also will continue his consulting practice.

Nielsen, Reeve & Maxwell, Inc., consulting engineering firm with offices in Ogden, Washington Terrace, and Bountiful, Utah, has increased its board membership from four to seven. Elected were John O. Reeve, Joseph E. Lawrence, Lew A. Wangsgard, and Jay R.

OPTIC NERVE FOR EYES THAT SEE 100 FEET BELOW THE SURFACE

This is a television camera. Its job is to photograph the substrata of excavations, thereby providing information needed by engineers in planning the construction of Boston's new Prudential Center, a modern, multi-million dollar real estate development.

Here in the Back Bay section of Boston, with its artificially maintained water table, this sealed camera must go down into a water-filled hole 100 feet below the surface. To transmit the picture from the camera to the surface monitor, Lake Service Corp. of Brighton, Massachusetts, designers and manufacturers of the television equipment, chose Simplex Anhydrex XX insulated cable because of its ability to withstand the rigors of submarine and direct burial duty.

For all types of service involving high and low voltages, whether aerial, underground or submarine, or for everyday plant wiring, it pays to call a Simplex Engineer.

BALANCED COMPOUNDING

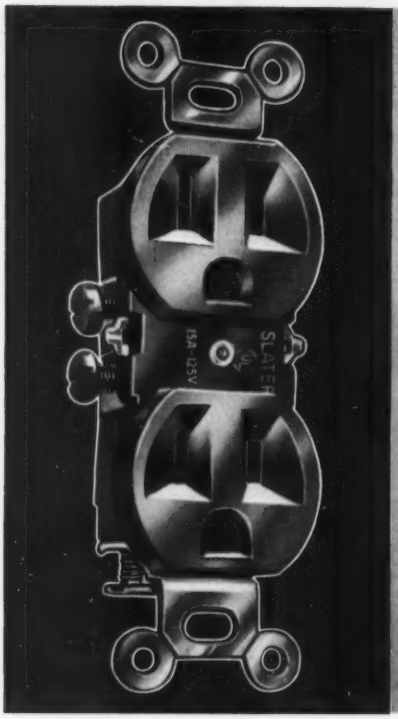
1885 Diamond Jubilee 1960
75 Years of Leadership in the Wire and Cable Industry

Simplex

WIRE & CABLE CO.

Cambridge, Mass. • Newington, N. H.

SPECIFICATION GRADE... LIFETIME WIRING DEVICES



#3200 3-wire grounding, DUPLEX RECEPTACLE

15 AMPS, 125-VOLTS*

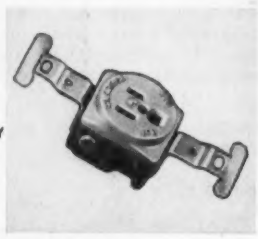
The Slater #3200 is a new compact shallow design duplex grounding receptacle with parallel slots and double-wipe contacts. Fully enclosed in phenolic body, the #3200 employs the exclusive "SLATER-LOCK" and easy break-off link to cut installation time.

Engineering Excellence is the heart of Slater leadership in wiring devices. This is because years-ahead thinking, planning and performing at Slater is based on widest experience, backed by modern facilities that are unsurpassed in the field.

Technical Superiority in construction, materials and production techniques assure Slater contractors unexcelled benefits in function and durability, as well as initial and long-range economy.

#3783
Weatherproof Flip-Lid with #3200 "U" ground receptacle. 15 Amps, 125 Volts

#600 modern, compact QUIET SWITCHES WITH SILVER ALLOY CONTACTS 15 AMPS, 120-277 VOLTS*



*Other Ratings Available

#5261—specification grade single grounded receptacle, 15 Amps, 125 Volts*

WRITE FOR THE LATEST SLATER CATALOG COVERING
Appliance Switches, Lampholders, Power Outlets, Receptacles, Switches, Weatherproof Devices and Wall Plates

Slater ELECTRIC & MFG. CO., INC.
45 Sea Cliff Avenue, Glen Cove, New York

Anderson, all of Ogden; H. Eugene Nielsen, North Ogden, and Art V. Maxwell and J. Dean Hill of Bountiful. Nielsen was named president and general manager; Reeve, vice president for design; Maxwell, vice president for field operations; and Anderson, secretary-treasurer.

A new firm, Angus D. Henderson, Consulting Engineers, with offices at 330 Winthrop Street, Westbury, New York, has been formed. The admission of Thomas J. Casey as partner also was announced.

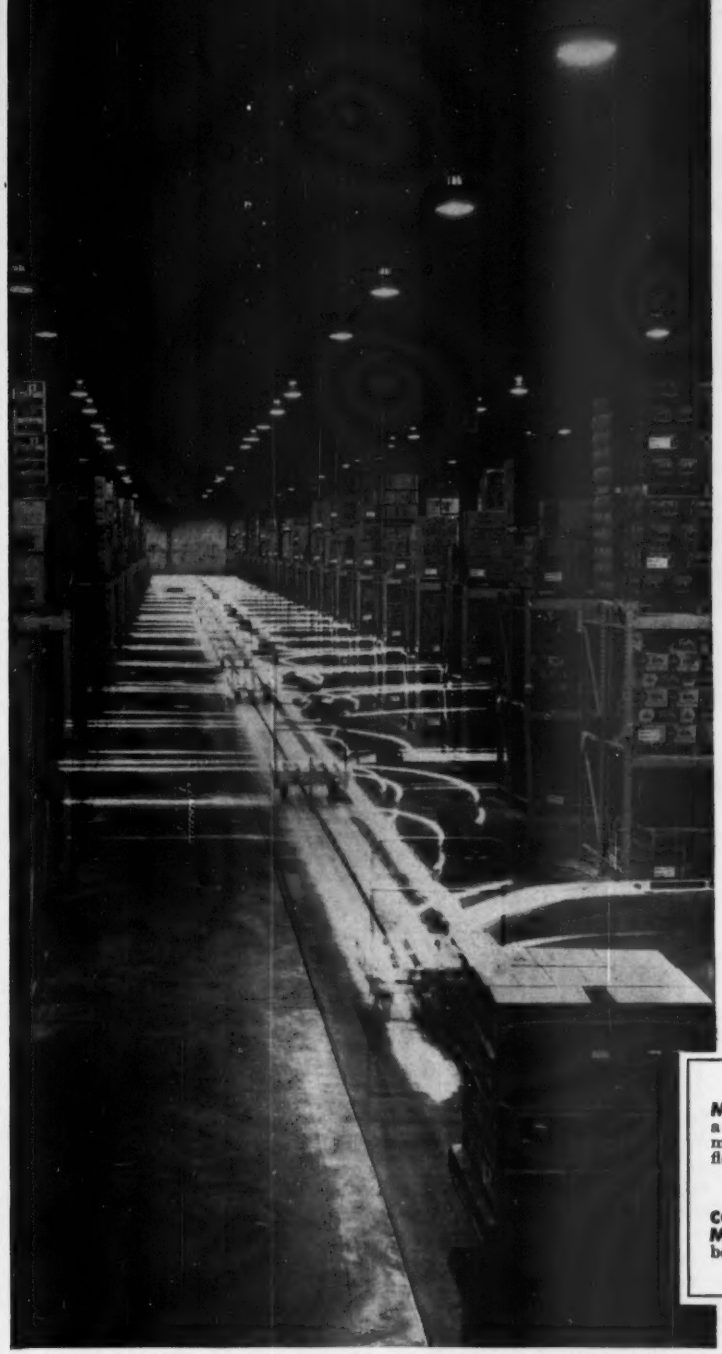
A. Bruce Onderdonk, consulting engineer, announces the formation of the firm of Onderdonk and Lathrop, consulting structural engineers, with offices at 2512 Main Street, Glastonbury, Connecticut. Robert P. Lathrop, the new partner, has been associated with Onderdonk since 1955.

Fred Ervin, formerly City Engineer of the City of Palos Verdes Estates, has joined the architect-engineering firm of Engineering Service Corporation, Los Angeles. Ervin will serve as division engineer in charge of planning and design.

Subsequent to the death of Elwyn E. Seelye, the remaining partners of Seelye Stevenson Value & Knecht, have agreed to continue the firm under the same name. The firm will continue the practice of consulting engineering in the fields of structural, civil, mechanical, electrical, and highway engineering, with offices at 101 Park Ave., New York, N. Y. and 271 North Ave., New Rochelle, N. Y.

Raymond C. Reese, consulting engineer of Toledo, Ohio, has been elected to a two-year term as vice president of the American Concrete Institute. Reese, a member of ACI since 1936, has participated in nearly every phase of Institute activity. Currently, he is chairman of ACI Committee 318, Standard Building Code. ▲▲

Nothing takes a bigger beating than your floors...



"TRACER LIGHTS" show typical, continuous, heavy floor traffic pattern of the "in-the-floor" tow conveyor trucks at Purity Stores, Ltd., Burlingame, California. • Chief Engineer—Purity Stores, Ltd.: Arthur Allison • Structural Engineer: H. M. Engle, San Rafael, California • Design Consultant: Harry Weese, Chicago, Illinois • Contractor: Younger Construction Company, San Francisco, California • POZZOLITH Ready-Mixed Concrete: Consumers Rock and Cement Co., San Francisco, California.

Only Masterplate floors take this concentrated traffic

2,000,000 lbs. of food are received, stored and shipped in a single day at this Purity Stores, Ltd. warehouse

Where long floor-life and cleanliness are musts (as in this seven-acre Purity Stores, Ltd. warehouse) MASTERPLATE iron-armored floors do the job better and more economically.

The thick, tough MASTERPLATE floor surface easily withstands the severe day-in, day-out abrasion of 234 tow conveyor trucks (with capacities up to 4000 lbs.). Food stuffs rolling out of Purity's warehouse to over 100 retail outlets are cleaner . . . because the MASTERPLATE floor does not "dust".

A MASTERPLATE floor costs less because:

- It lasts 4 to 8 times longer than the best plain concrete floor.
- It virtually eliminates costly shutdowns or interruptions.
- It costs less to keep clean.

Before you install or replace another floor, call in the local Master Builders fieldman for full information. Our unique "Floor Package" includes not only a *superior product*—MASTERPLATE—but 50 years of *application experience* on all types of installations, plus *on-the-job service* by a skilled MASTER BUILDERS field man.

The Master Builders Company, Cleveland, Ohio
Division of American-Marietta Company
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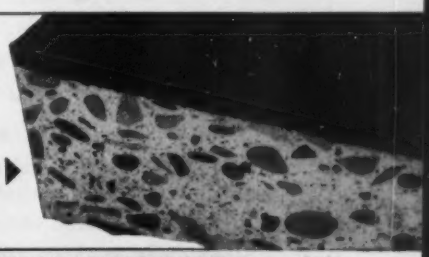
Branch Offices in all principal cities.


MASTERPLATE provides a thick . . . tough . . . malleable iron-armored floor surface.
CONCRETE BASE SLAB FOR MASTERPLATE surface can be monolithic or two-course.

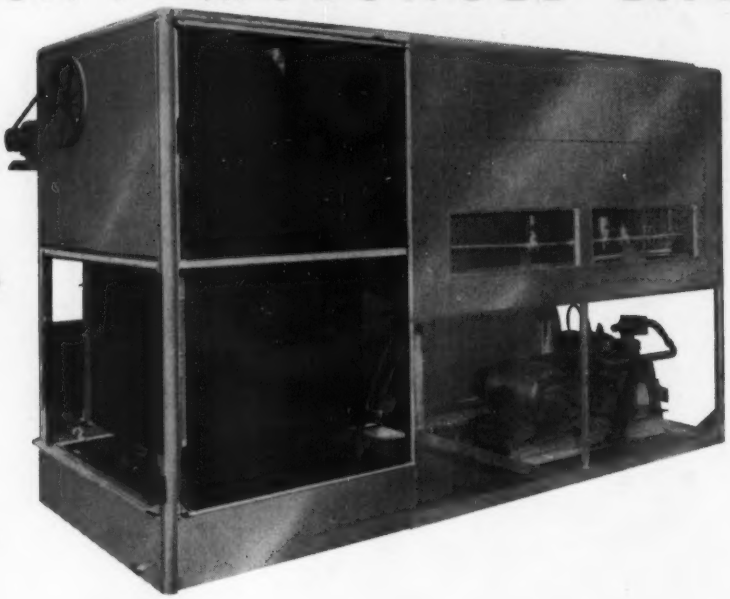
FOR FINISHING NEW CONCRETE FLOORS or re-surfacing old concrete floors—MASTERPLATE withstands impact . . . is oil resistant and virtually non-absorbent . . . easy to clean . . . resistant to many industrial corrosives and strong cleansers . . . *and outwears the best plain concrete floor 4 to 8 times* according to tests by top independent testing authorities.

MASTER BUILDERS® MASTERPLATE*

*MASTERPLATE *is a registered trademark of The Master Builders Co. for its specially prepared, metallic aggregate for producing iron-armored concrete floors.*

THE ULTIMATE
IN QUALITY
AND PERFORMANCE

SPECIFY PROLONGED LIFE!



Governair's COPPER FITTED EVAPORATIVE CONDENSER

FEATURES:

ALL COPPER AND BRASS water pan, float valve, condenser coil, spray tree, eliminators, blower scrolls. Standard galvanized blower wheels and stainless steel shaft.

WRITE FOR COMPLETE INFORMATION

You have a definite feeling of confidence when you specify Governair's COOPER-FITTED evaporative condenser with its many fine features.

ALL spray water is contained within a COPPER WATER JACKET. This exclusive DOUBLE WALL CONSTRUCTION assures product longevity and lower maintenance. In fact, throughout the entire unit, you find QUALITY . . . with no worry about faulty galvanizing or temporary corrosion protection.

You also have an extremely WIDE SELECTION, as this evaporative condenser is supplied for REMOTE installation or as an integral part of Governair Corporation's self-contained PACKAGED equipment . . . Conventional; Multi-Zone (as pictured); and Water Chillers.

GOVERNAIR

4840 N. SEWELL • OKLAHOMA CITY

Reporting

The New Projects

Ocean Outfall in Ghana

What is undoubtedly the world's heaviest sea pipeline, with a total weight of 2000 tons, was laid recently in the Gulf of Guinea, Ghana. It forms an ocean outfall for the port of Tema and is over 6000 feet in length. Sewage discharge will be at a distance far enough from shore to avoid all danger of beach contamination. The internal diameter of the Tema outfall is 27 inches.

The project was designed and supervised by the consulting engineering firm, D. Balfour and Sons, of London, and the size of the contract was $1.4 million. A team of 150 American, British, and Ghanian workers finished the entire construction job in six months.

Ceiling Symposium

Consulting engineers, architects, and contractors joined in a symposium covering the unique ceiling design being used in the new Union Carbide Building on New York's Park Avenue. The formal program included four short addresses: "Architectural Concept of the Ceiling System," by R. K. Posey, associate partner of Skidmore, Owings, and Merrill; "Engineering Aspects," by Arnold L. Windman, associate, Syska & Hennessy; "Acoustical Considerations," by R. B. Newman, vice president of Bolt, Beranek & Newman; "Fabrication and Installation," by Donald Byrne, project manager, George A. Fuller Co. Each presentation was followed by a question and answer period.

The modularized design incorporates functional applications including partition anchorage, lighting, air circulation, and sound barriers. The module is 2 feet 6 inches by 5 feet, adaptable to almost any sized space anywhere in the building. The 70,000 lighting units cover nearly 900,000 sq ft, the largest ceiling of its kind in the world. Four watts of power per square foot maintain an illumination level of about 80 footcandles.

Other features of the ceiling system include:

¶ Translucent laminated plastic diffusers.

¶ A grid of cold-rolled-formed stainless steel runners which serve as a framework for the lighting fixtures, as top anchors for the movable partition panels, and as control nozzles for the dispersion of conditioned air as well as the intake for used air.

¶ Individual reflectors which act as sound baffles and with contours which adjust the intensity of illumination evenly across the face of the diffuser.

¶ Quick starting fluorescent lamps with easily changed ballasts.

¶ Special polyurethane gaskets for light and dust sealage and to cut down on reverberating sound.

All of the subject matter of the symposium is available on request from: Union Carbide Corporation, Public Relations Department, 30 East 42nd St., New York 17, New York.

Power Survey for North Dakota

The New York firm of Burns and Roe, Inc. has been retained to study the power supply needs of the North Dakota area. This project was commissioned by five utilities: the Otter Tail Power Company, the Minnesota Power Cooperative, Inc., the Central Power Electric Cooperative, Inc., the Dakota Electric Cooperative, Inc., and the Northern States Power Company. Henry Schoenwetter has been assigned as project engineer.

The survey will provide cost estimates on power production, plant features, and water supply. Site investigations, electrical load analysis, and system development and investment costs will be included. Concurrently, the sources and availability of lignite, a potential fuel in this area, are being investigated by the Paul Weir Company, Chicago, Illinois.

Bamboo Pulp Mill

L. H. Manderstam & Partners, consulting chemical engineers, of London, England, are designing an $11 million pulp mill at Lamsakhang in Assam, India. This facility will be the first nonintegrated bamboo pulp unit in the world. The new mill which will manufacture 100 tons of pulp a day, will be completely self-contained and provide all

its own services and principal chemicals. It will be located in the heart of the Assam bamboo reserves. The pulp will be shipped in dry sheet form to Indian industrial areas where it will be converted to paper by conventional methods.

Sand Compaction Used at Cape Canaveral

For the first time, sand compaction instead of pilings will be used for the foundation of a missile launching facility at Cape Canaveral. The Corps of Engineers, U. S. Army, began construction on Complex 34 early this year with the Vibroflotation Company, a subsidiary of Rust Engineering Company, Pittsburgh, Pennsylvania, in charge of compactions. Four Vibroflot machines will make 1617 compactions starting at an average depth of 25 feet and working upward in one-foot lifts, with 30 working days to complete the job.

Vibroflotation is the compaction resulting from simultaneous vibration and saturation of a granular soil, removing the voids, and rearranging the grains into a tight mass. The only materials required are sand and water. The technique has been used at Eglin Field, Florida, for a smaller rocket launching facility and at Harmon Air Force Base, Newfoundland, for the underpinning of an alert hangar foundation.

Production Line Produces Space Frame

A 1200-ton space frame was specified for a 450-ft square building designed by Skidmore, Owings and Merrill for the Upjohn Company at Kalamazoo, Michigan. Steel pipe and other structural materials were considered for the structure, but the final decision from among the techniques studied was to use welded angle construction.

Low bid came from Whitehead and Kales, Detroit structural steel contractors, who proposed to use production line techniques for fabrication. A pilot section was tested to failure before final fabrication was begun. Steel erection was completed in the fall and occupancy is scheduled for the latter part of 1960.

Rust Preventive Coating

According to Dr. Robert F. McCauley, a professor of civil engineering at Michigan State University, a community can rust proof the iron pipes of its water distribution system with minimum effort and expense.

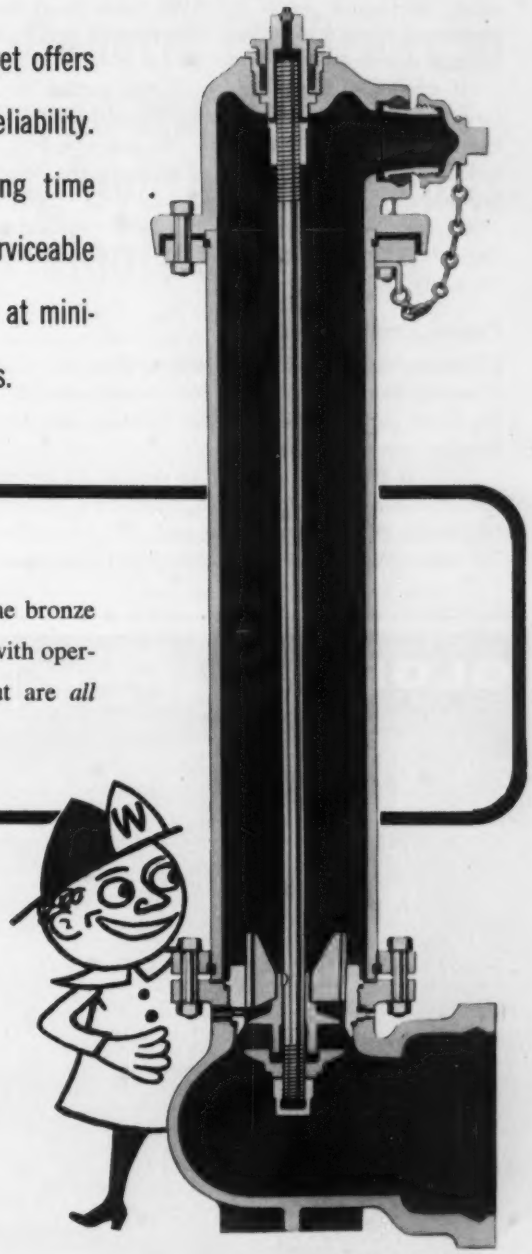
"Although most new water systems use iron pipes coated with cement to prevent rust," he says, "there are thousands of older systems being used in which rust forms readily and creates major problems."

McCauley notes that the principles involved and the chemicals used have been known for years. But a new factor that he has found important is the rate of flow of water. It must be very fast. The procedure calls for adding metaphosphate and one or more of the following chemicals to the water: lime, soda ash, caustic soda, and calcium chloride. Since these chemicals are already present in the water, the amount and type depend on an accurate

Production line fabrication was used for space frame truss on new Upjohn Company building in Kalamazoo.

THE R. D. WOOD HYDRANT

The R. D. Wood Hydrant is simple in design, yet offers all the features needed for the utmost reliability. Your community would have to look a long time before it would find another hydrant so serviceable and rugged. For full neighborhood protection at minimum outlay, look first at R. D. Wood Hydrants.



BRONZE PARTS

Every point of friction is protected by at least one bronze surface. This assures against rust and interference with operation. The stuffing box, gland and operating nut are *all bronze*—corrosion-proof!

AND THESE FEATURES, TOO:

Valve opens against water pressure, remains closed in case of accident. Head revolves 360°. Optional break-point flange and breakable stem coupling permit quick repair without excavating. Optional extension piece can be inserted without shutting off water. Available with bell, mechanical joint or flange pipe connections; conventional or "O" ring packings.

Conform to latest AWWA specifications

R. D. WOOD COMPANY

Public Ledger Building, Independence Square, Philadelphia 5, Pa.

Manufacturers also of Mathews Modernized Hydrants, Mathews Flange Barrel Hydrants, R. D. Wood Gate Valves, and "Sand-Spun" Pipe (centrifugally cast in sand molds)

analysis of the fluid being used. After treatment, the water flows through the pipes at a rate of six feet per second. In two hours the pipes are coated with a hard, thin layer of limestone (calcium carbonate) and normal water may be returned to the pipes.

"The chemicals are harmless in the amounts used," McCauley points out. "We have drunk the water ourselves. However, the treated water is slightly distasteful.

"It would be best to do only one section of a city at a time, preferably during the early hours of the morning when few people are using water. A few hydrants could be opened to make the water flow rapidly."

To date, McCauley's work has been confined to the laboratory, but he hopes to try the method on a city system soon.

Project Mercury

Following the signing of a $30 million contract, Western Electric, as prime contractors, identified the major participants in Project Mercury and their specific responsibilities:

Burns & Roe, Inc., consulting engineers, are responsible for architectural and engineering services to provide ground support for each site. More than 300 company engineers will participate in this phase of the project which concerns 18 different sites, including two ships.

Bendix Aviation Corporation will supply ground-to-capsule voice communications equipment, radar equipment, ground control equipment for the capsule, and telemetering equipment.

Bell Telephone Laboratories, Inc. will handle basic systems engineering associated with communications and visual presentation.

Western Electric Company, Inc., as the prime contractor for the project under the National Aeronautics and Space Administration, will be responsible for managing and directing the activities of the other team members so that the specified capability and reliability are met on schedule.

Preliminary operations on the network began in July 1959 and actual construction is now under way. Completion is scheduled for late 1961.

Concrete Slabs Save $90,000 on School

The use of prestressed concrete lift slabs saved almost $100,000 in a recent Los Angeles school project. Ed Rise, a partner in T. Y. Lin and Associates, consulting engineers, says that the elimination of roofing, the speed of construction, and the simplicity of design contributed to this savings.

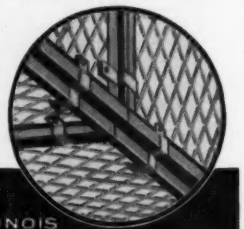
The new school, the 112th Street School, comprises two buildings. Two 72′ x 143′ 8″ watertight

GLOBE SAFE·GARD (FORMERLY HILMAR) EXPANDED METAL PARTITIONS with exclusive QUIK-ERECT patented fittings

...will answer all your enclosure problems

Here is the new, easier, simpler method of guarding conveyors and machines and for all in-plant partitioning. Shipped READY for erection, no cutting, drilling or welding required . . . these interchangeable expanded metal panels provide greater safety, cut overall costs, cover a wider range of use and require 85% less storage space.

EXCLUSIVE QUIK-ERECT SECTION CLIPS save much of the erection time formerly required. Proven successful in hundreds of installations, these Safe·Gard panels are of welded construction, give longer life, are more rigid and stronger than wire, will not ravel or fray.



Note enlarged detail showing SAFE·GARD Quik-Erect Clips securely joining the interchangeable panels.

Write today for more details or call your Globe (Grip-Strut) Distributor. Distributors in all principal cities, listed under "Grating" in your phone book.

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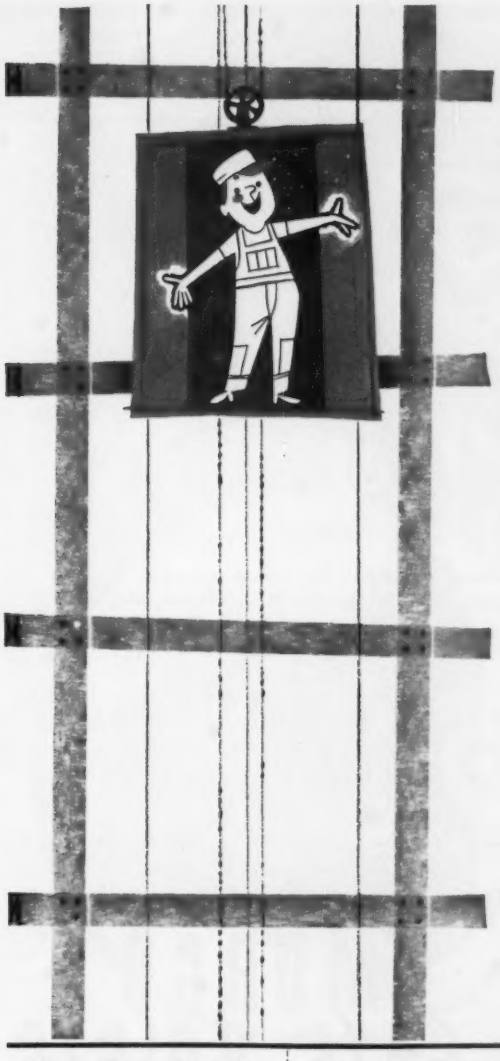


NAME YOUR FLOOR

and General Electric can give you the underfloor wiring system that suits your electrical needs

General Electric makes four types of underfloor wiring systems —everything you need in order to handle any combination of electrical and structural requirements, in any size or type of building. The examples below show you which G-E system goes with each type of floor construction.

EASY INSTALLATION! All General Electric systems are designed for easy installation. For example, with the G-E single-level duct systems, center-duct runs can be fed through the conduit openings in the corners without need for field adaptations. Junction boxes can be leveled without removing the covers.

For valuable manuals with complete layout, design, product, and installation facts, mail the coupon now.

Progress Is Our Most Important Product

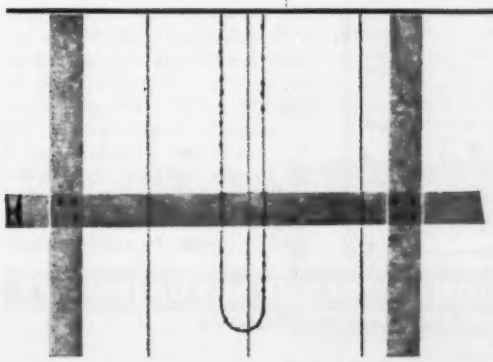
GENERAL ELECTRIC

1. For cellular steel floors: The G-E cellular-steel floor wiring system permits outlets on six-inch centers throughout the floor area. Header duct also available for modified cellular floors combined with sections of roof deck.

2. For concrete floors and standard layouts: G.E.'s single-level steel standard duct system can be used in concrete fills as shallow as 2½ inches. Easy-leveling, durable junction boxes have large interiors for quicker wire pulling.

3. For concrete floors and heavy electrical loads: G-E single-level BIG DUCT boasts an 8½ square-inch cross sectional area to accommodate heavy power wiring and multi-conductor communications cables. Can be used in 3-inch minimum concrete fills.

4. For concrete floors and maximum flexibility: G.E.'s two-level duct system permits multi-location feeding without awkward conduit home runs. Feed through the lower level with distribution through the top level. The ideal solution to difficult feeding problems when 3½ inches of fill are available.



General Electric Company
Conduit Products Department, Section CU 90-436
Bridgeport 2, Connecticut

Please send me the bulletins checked below:

- ☐ Single- and two-level steel underfloor systems.
- ☐ Cellular-steel floor wiring system.
- ☐ I have enclosed a description of my underfloor wiring problem. What do you suggest?

Name_____ Title_____

Company_____

Address_____

City_____ Zone_____ State_____

roof slabs were used. They were prestressed in both directions with Prescon cables. After the slabs were cast and prestressed on top of the grade slab, they were lifted to their exact elevation and attached to the precast concrete columns by slipping a steel bar through the column. The designers have found this connection detail to be both economical and time-saving.

Public Works Project in Argentina

A joint venture of R. W. Booker and Associates, consulting engineers of St. Louis, Tellepsen Construction Company of Houston, and Smith, Hinchman & Grylls Associates, Inc., architects and engineers of Detroit, was initiated recently in the province of Mendoza, Argentina. The project entails an extensive study of the technical, economic, and financial aspects of a public works program to be financed by oil revenues.

Located in the west central portion of Argentina, Mendoza is a growing industrial and agricultural area with a wealth of oil resources. The governor, Dr. Ernesto Ueltschi, and his advisors have recognized the need for a realistic program of public works that will support their province's growth.

The Booker joint venture group will develop a logical, coordinated plan which will include recommendations for the construction of dams, hydroelectric power plants, electric power transmission lines, irrigation systems, roads and bridges, and public buildings. Each of these proposals is expected to receive interim financing from private sources.

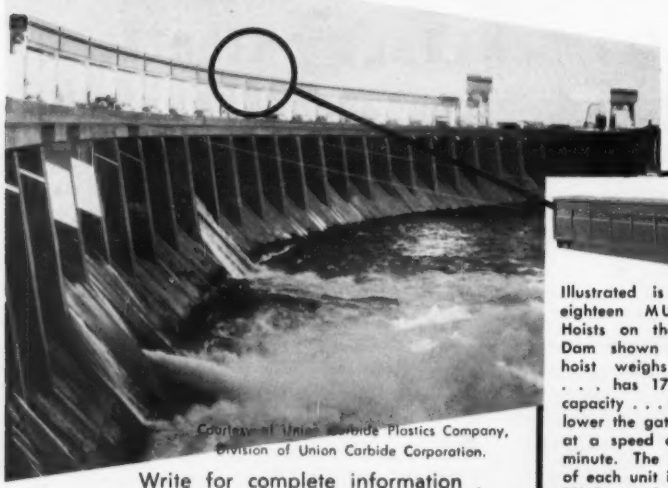
New Ohio River Bridge at Louisville

A new $15 million bridge across the Ohio River and connecting Indiana and Kentucky near Louisville, will be completed late in 1961. The 1600-ft structure is of a tandem, tied-arch, double-deck design and requires fabrication methods used for only one other bridge in the history of bridge

Indiana-Kentucky bridge is unique tandem, tied-arch, double-deck design with two 800-foot long spans.

. . to control water level at Long Sault Dam, St. Lawrence Power Project

MURCO GATE HOISTS



Courtesy of Union Carbide Plastics Company, Division of Union Carbide Corporation.

Illustrated is one of the eighteen MURCO Gate Hoists on the Long Sault Dam shown above. Each hoist weighs 93,000 lbs. . . . has 175 tons lifting capacity . . . will raise and lower the gates in the dam at a speed of 1 foot per minute. The overall length of each unit is 57 feet . . . 8½ feet wide and 12½ feet high. Write for complete information and Engineering Department recommendations.

For the second largest hydroelectric power plant in the United States at Massena, New York—as part of the St. Lawrence power project—Uhl, Hall & Rich, project engineers selected MURCO Gate Hoists to control the water level at Long Sault Dam. MURCO Gate Hoists are designed from knowledge and experience . . . backed by over 75 years in design and manufacture . . . made for any size power dam . . . capacities from less than 1 ton to over 100 tons . . . from the smallest hand operated to the largest motor operated gate hoist, all made to specifications.

Write for complete information . . . . Engineering Department recommendations . . . when you are planning power dam projects.

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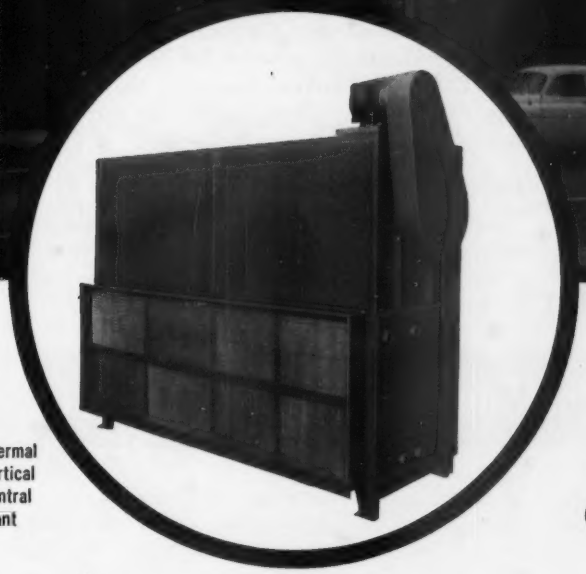

Thermal Vertical Central Plant

20 THERMAL Central Plant Units Air-Condition Houston Library

The Julia Ideson Building of the Houston Public Library was recently remodeled to include air conditioning. Here, again, Thermal equipment is providing the big difference in comfort for citizens reading for work or recreation.

The rapidly increasing number of buildings throughout the country using Thermal Engineering's air conditioning and ventilating equipment is recognition by architects, engineers and owners of its quality and service.

The Thermal line of finer equipment includes central and multizone conditioners, sprayed coil units, heating and ventilating units, heating and cooling coils, and air-cooled condensers. Types and sizes of all units are available to meet the architectural requirements of all kinds of buildings and weather conditions.

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AGENTS IN PRINCIPAL CITIES

building, the cantilever truss Carquinez Strait Bridge which is located in California.

The steel superstructure of the bridge will be fabricated in, and shipped from Detroit by R. C. Mahon Company, the structural contractor. It will consist of two 800-ft, double-decked spans. Each deck will carry a 42-ft wide, triple-lane road, with safety walks on each side.

The bridge is planned as a link in the interstate highway route 64 from Richmond, Virginia to St. Louis, Missouri. The Federal government is paying 90 percent of the costs with Indiana and Kentucky each paying 5 percent. Hazelet & Erdal, consulting engineers of Louisville, are responsible for the bridge design and supervision of construction.

Saxton Experimental Nuclear Reactor

Construction of an experimental nuclear reactor was begun early in February near Saxton, Pennsylvania. The purpose of the project will be to determine ways in which more useful heat can be obtained from nuclear fuel and ways in which the heat produced can be used more efficiently in producing electric power.

After excavation of some 6000 cubic yards of material, a cylindrical-shaped, domed building 50 feet in diameter and 110 feet high will be built. Construction by the Bethlehem Steel Company will consist of 238 tons of steel plates, up to three-quarters of an inch in thickness. Almost 50 percent of the building will be below the ground level.

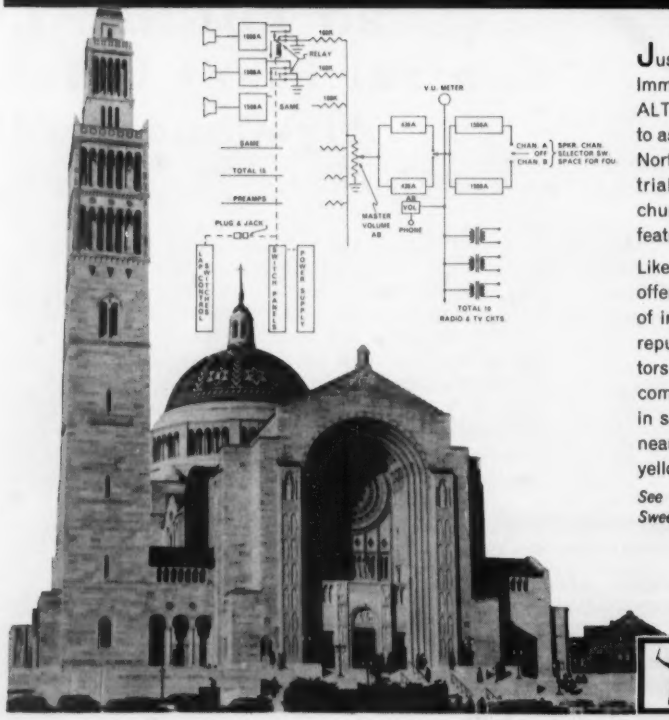
The reactor vessel, to be built by the A. O. Smith Corporation will be cylindrical in shape. It will be 58 inches in diameter, 17 feet high, and will weigh a total of 50 tons. Walls, approximately five inches thick, will be constructed of carbon steel and lined with stainless steel. Inside the unit uranium oxide will be used to generate heat. The steam thus generated will be used to operate a turbine in Pennsylvania Electric Company's nearby Saxton generating station.

Pennsylvania State University will participate in the program which is being financed by the Pennsylvania Electric Company, Metropolitan Edison Company, New Jersey Power and Light Company, and Jersey Central Power and Light Company. Westinghouse Electric Corporation designed the reactor and has the contract for its construction. Paul G. Davis, of Gilbert Associates, Inc., of Reading, Pennsylvania, is responsible for non-nuclear design and construction supervision.

Italian Consultants Design Brazilian Dams

Two major hydroelectric projects in the Brazilian state of Rio Grande do Sul have been secured by Electroconsult of Milan, Italy. One of the power

Catholic National Shrine Sound Engineer* *specified* ALTEC



Just completed after 30 years of building, the Shrine of the Immaculate Conception in Washington, D. C. features 485 ALTEC-engineered products in its sound system. Often referred to as the Catholic National Shrine, it is the largest cathedral in North America. In common with thousands of public and industrial buildings, stadiums, auditoriums, hospitals, schools, churches and shopping centers all over the world, the Shrine features the pure sound of an ALTEC system.

Like all ALTEC products, ALTEC commercial sound systems offer dependable service under all conditions, longer life, ease of installation and service—factors which enhance your own reputation. Hundreds of ALTEC engineer-consultant contractors can serve you with 100 different sound components or complete systems designed to your specifications. For the best in service, the best in sound—talk over your project with the nearest ALTEC contractor. Look for him in the phone directory yellow pages, or write ALTEC at the address below.

See Altec's listing in:
Sweet's Catalogue Industrial Construction File (17e/AL), 1960 Edition.

*Shrader Sound, Inc., Washington, D. C.

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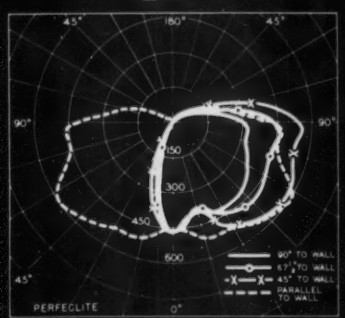
Made of cast aluminum, gasketed and weatherproofed, the Pharos opens on concealed hinges for easy relamping, easy maintenance. It is rated at 200 watts, utilizing a standard A-25 lamp.

For further information, mail the attached coupon today!



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dams will be located on Rio Passo Fundo and the other on Rio das Antas. Both are in the north central part of this southernmost state of Brazil.

The Passo Fundo power station will have an installed capacity of 300,000 horsepower, exploiting the 528-ft drop of the Rio Fundo into the Erechim. The Rio Antas plant, built at a natural waterfall of 400 feet will have a capacity of 200,000 horsepower. This output will help meet the rapidly increasing requirements of the state and the area adjacent to it.

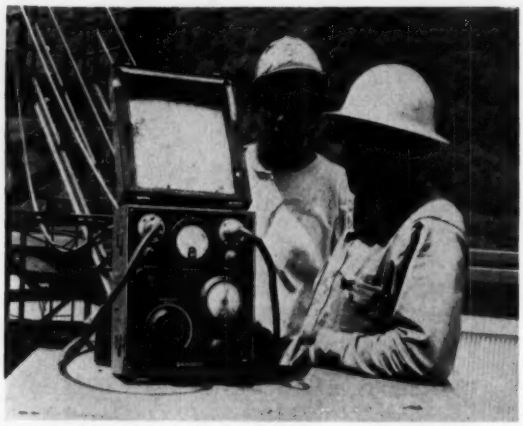
At last count, Electroconsult had six major projects underway in Latin America.

Yankee Reactor Uses X-Ray Inspection

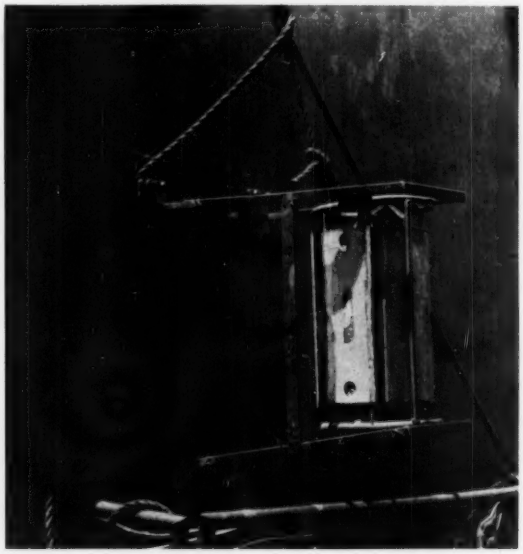
The Yankee Atomic Reactor located at Rowe, Massachusetts, is a joint project of the Westinghouse Electric Corporation and Stone and Webster Engineering Corporation. The reactor plant itself consists of a 125-ft diameter steel sphere set on eight reinforced concrete columns and 16 steel pipe supports. The shell houses the reactor steam generator with its pumps, heat exchangers, and auxiliary systems. Efficient step-by-step inspection of this plant during construction was essential to its completion on schedule.

The contractors, The Chicago Bridge and Iron Company, solved this problem by the use of X-ray inspection. The equipment used was a Baltospot 200 and a Baltospot 260 for 100 percent testing and a smaller Baltospot 140 for sample checks where the requirements were not so exacting.

The $50 million, 134,000 kilowatt facility is scheduled for completion late in 1960 and will supply power to six New England states. Eleven New England utilities joined together in 1954 to form the Yankee Atomic Electric Company and they are the sole owners. Under a contract with the AEC as a part of the Power Demonstrator



Control unit for X-ray inspection equipment used in checking the reactor plant at Yankee Atomic Reactor.



Lightweight block and tackle hoist is tied to wheeled carriage of 85-lb X-ray inspection unit on reactor.

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In addition to superb cuisine and luxurious comfort in the intimate club atmosphere of a 350-acre estate, the hotel offers a championship golf course, a great pool with cabanas, deep-sea fishing cruisers and a long list of other facilities for fun outdoors. 100% air conditioned. American Plan.

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GRAND HOTEL — Point Clear, Alabama

Murray Stevenson, Vice President

Owned and operated by Southern Industries Corporation, Mobile, Ala.

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PANALARM ANNUNCIATORS record critical information on 7 turbine generators related to differential shutdown, overvoltage, ground detection, motor control, loss of field, pressures, temperatures, and shutdown or bus tie transfer operations.

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Reactor Program, Yankee receives an additional $5 million for necessary research and development.

London's Victoria Tower Rebuilt

This year the Victoria Tower of the British Houses of Parliament, designed by Sir Charles Barry, reaches its centenary. Until recently, the lower stories of the structure bulged with Parliamentary archives, and it was apparent that more storage space was needed. In addition, the structure was becoming dangerous. For some years it has been known that the internal structure of the tower was overloaded. Barry himself discovered it too late and used a number of tricks to disguise it. Now, with British tradition and pride the overriding factor, it has been decided that the edifice be rebuilt with as little outward change as possible.

The tower is not the simple structure it seems. It is 75 feet square and 330 feet high, the largest square tower in the world. It is built over the Royal Porch in which Queen Elizabeth II alights from her coach to open Parliament. Above the porch's vaulted roof Barry inserted four enormous cast iron beams, 4-ft deep, across the corners inside the tower walls. On these beams he placed eight cast iron pillars which continued up through the center of the shaft to the roof. These pillars, and consequently the four beams in the Royal Porch roof, carried the entire weight of the interior of the tower – about 900 tons.

The 300-ton iron staircase, said to be the longest spiral staircase in the world, rises in a central well and is truly a hanging stair. It is suspended by vertical iron rods from each flooring assembly through which it rises.

The first three stories, with their staircase, are being retained. Apparently at floor "D" Barry realized he might have underdesigned the structure. He began to do all sorts of things to reduce the load on the beams below. He omitted some floors entirely. The fifth story floor is 4-ft thick and excessively strong, evidently to secure stability. A curious bit of 19th century whitewash is revealed when one examines the doors on the upper landings. They are identical with the doors below except for the words "No access" on them. Each one is a dummy. There are no rooms or floors behind them. It is from this point on up that the staircase and landings have been dismantled and the cast iron beams and pillars that carried them have been cut down and carted away.

A small spiral staircase in one of the turrets is being used for access to the upper parts of the tower during construction. A plumbline hanging down from the 200-ft roof reveals a tilt of 15½ inches. It is believed that Barry "built into the wind" but it could be due to settling of the building during the early years of its existence. There has been no increase in this movement in recent times.

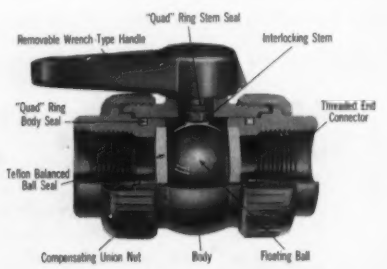
A remarkable part of the reconstruction was the lifting of the 350-ton roof from its original girders and resetting it on its new supports. This complicated operation used 16, 20-ton jacks which forced wedges to lift the roof the width of a paper off the supporting pillars. Then the pillars were cut off and the roof gradually lowered onto its new bed.

In the new construction, 30-in. steel girders are being used to carry each of the floors. The ends of each girder will be anchored in pockets in the 6-ft thick masonry and the tower walls will bear the load. When the new Victoria Tower is finished in the summer of 1961 it will have 14 stories instead of the original 10. Its life span and its usefulness will be improved beyond measure.

Largest Nuclear Power Station in the World

Bids are being sought for what will be the largest nuclear power station in the world, located at Sizewell on the east coast of England. Its capacity will be 650 megawatts and its cost is expected to be in the $170 million range.

Permission for building an even larger nuclear power station is being requested and the decision will be announced shortly. This station, to be built at Oldbury, Gloucestershire, will have a 1000 mega-



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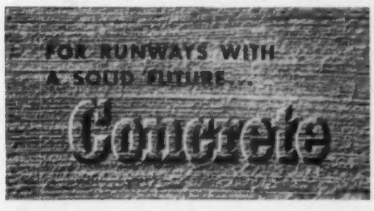
Los Angeles gets ready for jets. Photo shows modern equipment now placing new concrete directly on the old flexible pavement of runway 25L. They're paving 1,600 feet of 25-ft. strips every working day, will take just 120 days for the whole 150-ft. x 6,150-ft. runway! *Artist's sketch at top of page shows how airport will look with modern concrete runways and new futuristic-styled terminal area.*



A 12-inch overlay of concrete provides needed strength to handle the heaviest jet wheel loads ever expected.

Concrete is the only true jet-age pavement. On runways *built specifically for jets*, concrete has been the overwhelming choice.

And in reconstruction, where the old flexible pavement can still serve as a subbase, covering it with minimum-thickness modern concrete gives big savings.

Such overlays are possible because concrete is *not flexible*. The strength is in the concrete itself—and not in built-up, layer construction. Concrete is more than a *smoothing* overlay. It's the one pavement with beam strength that enables engineers to compute loads mathematically, design airport runways for an expected life of *50 years and longer!*

And hot jet blasts can't melt concrete or chew it up. Spilled fuels do no damage, either. Light-colored concrete with its natural grainy surface is the high safety pavement, too. You get better visibility at night and dependable skid resistance whatever the weather.

These are all good reasons, too, why concrete is the preferred pavement for heavy-duty highways—such as those being built for the new Interstate System.

PORTLAND CEMENT ASSOCIATION

A national organization to improve and extend the uses of concrete

watt capacity and will probably be using a new type of reactor. This will be the Advanced Gas Cooler Reactor. A 28 megawatt prototype is now under construction for Britain's Atomic Energy Authority at Windscale, Cumberland.

The AGCR will burn uranium oxide fuel which has been slightly enriched with additional quantities of uranium 235, instead of the natural uranium. It will operate at temperatures about 200 degrees above those contemplated for Sizewell and will reach a capacity of 500 megawatts for each reactor compared with 350 megawatts output planned for Sizewell. At the Sizewell station it is expected that capital cost will fall below $280 per kilowatt of installed generating capacity for the first time.

At the present time there are five nuclear power stations under construction in England: Bradwell, Essex (300 Mw); Berkeley, Gloucestershire (275 Mw); Hinkley Point, Somerset (500 Mw); Trawsfyndd, Merionethshire (500 Mw); and Hunterston, Ayrshire (325 Mw).

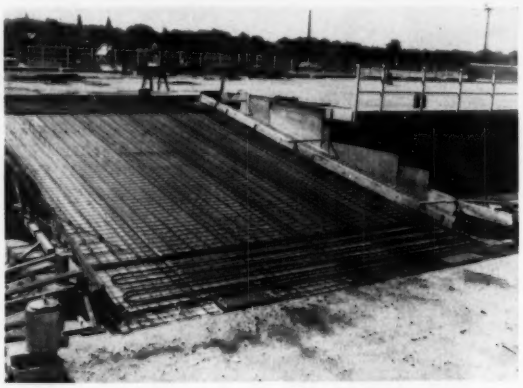
In addition to the stations at Sizewell and Oldbury, another station is in the planning stage. It will be located at Dungerness, Kent.

Snow Melting Pads

Snow removal on the top deck of the *Akron Beacon Journal's* new parking garage has been simplified by the use of two snow melting areas. These pads, only 560-sq ft (28-ft x 20-ft) each, take care of a 26,600-sq ft deck surface. The pads are heated and when the snow is piled on them it melts and drains to the city sewers.

Each pad has a network of 4-D wrought iron pipes enclosed in a 3¼-in. thick concrete slab which is placed over a 5-in. thick structural slab. A mixture of hot water and ethylene glycol is circulated through the pipes. This heats the concrete which, in turn, melts the snow.

In addition, similar piping is used for snow melting systems in the garage's sidewalks and access ramps. For the sidewalk area, 6-in. of gravel was placed and covered with a membrane. Then a combination grid and coil pipe system was enclosed in concrete. On the 8-degree ramp to the unsheltered top deck the snow melting system was installed in an 8-in. thick concrete slab.



Garage access ramp on 8-degree slope has imbedded heating coils for winter snow removal from slab.

The system was designed for 140 F temperature with a melting rate of 100 Btu/sq ft. Cost of installing the system was $20,000. The Ohio Edison Company supplies the necessary steam for the melting system's hot water generator, and the estimated operating cost is $1.40 per hour. Lind & Scheeser, consulting engineering firm of Cuyahoga Falls, was responsible for the design.

Fuel Element Laboratory in a Cave

E. G. Irwin and Partners Ltd., a consulting engineering firm of London has accepted a project for the design and provision of an irradiated fuel cave laboratory. Britain's Atomic Energy Authority will have control of the facility and its value will approach $3 million. The installation will be located in the blower houses of No. 2 reactor of the Wind-

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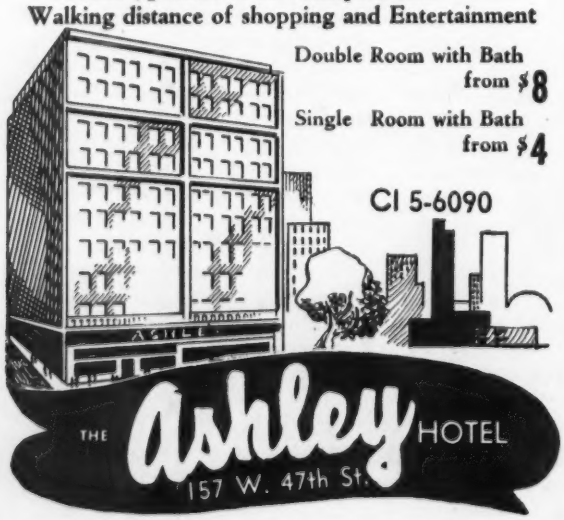

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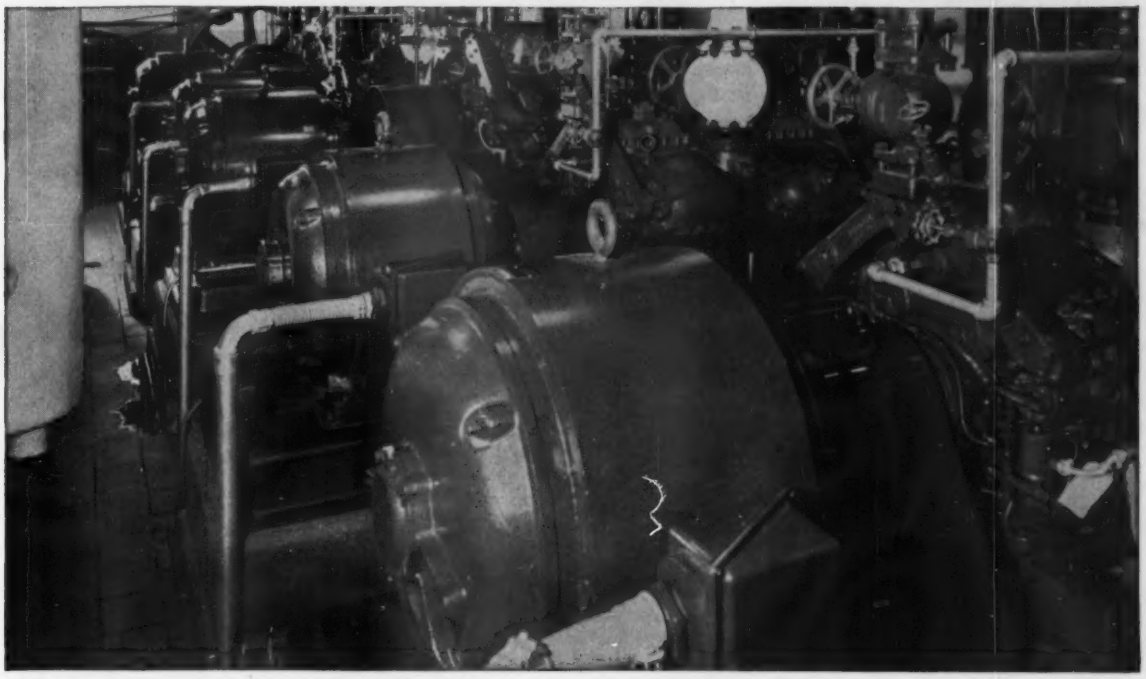

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Line disturbances are reduced because current taken from the line is not broken during the starting period. Motors start sure and fast . . . reach full speed in a matter of seconds. And . . . Wagner combinations cost less than motors with primary resistance or auto-transformer type starters.

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scale Works, Cumberland, which closed down as a safety measure several years ago.

Several thousand fuel elements a year from both nuclear power stations and the experimental reactors will be handled. All the work done on the elements from the time they arrive until disposal will be by remote control, the machinery to be designed by Irwin and Partners and tested by them in their London offices. All equipment can be rearranged or replaced after decontamination without the necessity of personnel entering the caves. Other major design considerations are:

¶ To permit superficial examination of the facilities and also radiography.

¶ To provide apparatus for sorting out the good from the bad elements.

¶ To provide a means for taking the fuel rods out of the cans in which they are contained without distorting either.

¶ To provide apparatus for dimensional and density measurements of the fuel rods.

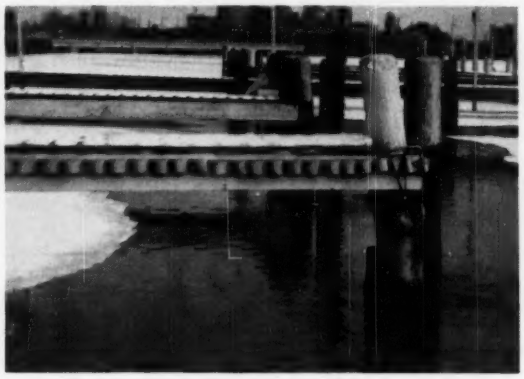
¶ To enable sections of the cans and fuel rods to be processed for passing along to the metallurgical laboratory.

To ensure that the working areas remain free from contamination, the pressure in the caves is kept below atmospheric pressure so that any leak that develops would occur inward.

The project, which is scheduled for completion by the end of 1960, also includes dark rooms, laboratories, offices, change rooms, and store rooms. As Irwin says, "The work involved in this project can be divided into four groups: civil and building, heating and ventilating, special purpose equipment, and instrumentation. A project such as this, although requiring a large number and variety of specialist engineers and designers, is made much easier with all the departments under one roof."

Air Compressors Protect Marina From Ice

Last fall the Charles River Yacht Club, in Cambridge, Massachusetts, installed an air system at



Marina is kept ice-free by compressed air jets on river bottom which force warm water to surface.

pierside that maintained a 15-ft stretch of ice-free water all winter long. The damage to floats and piers of previous years has so far been entirely avoided. Joseph Legasse, a local consulting engineer, designed the system.

Two air compressors pump air through pinpoint holes in 1500 feet of pipe located near the river bottom along the edge of the piers to be protected. This forces the warmer water from the bottom of the river – where it is at a temperature of approximately 38 F – to the surface.

New Orleans Office Building

The largest office building in New Orleans is now under construction. The 421,000-sq ft, 28-story structure is located at the corner of Baronne and Gravier Streets and is scheduled for occupancy late in 1961. Financial arrangements included a loan in excess of $8.5 million from the Metropolitan Life Insurance Company. Architectural and engineering supervision for the project will be supplied by Shaw Metz and Associates of Chicago and A. W. Thompson and Associates of New Orleans. ▲▲

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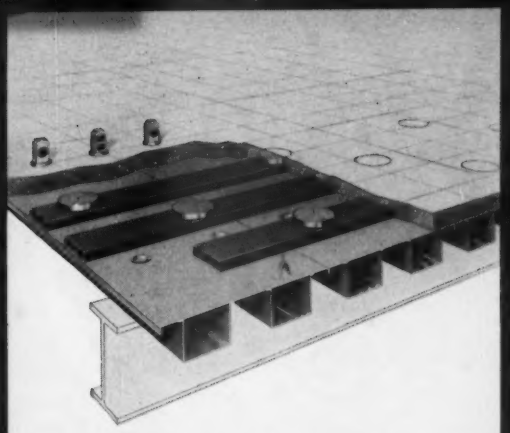
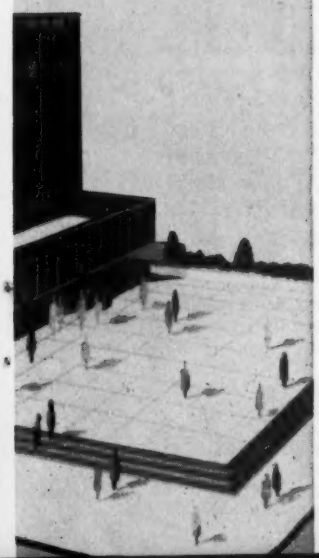


Sectional view of typical M-Floor construction: This electrified steel cellular floor, using M2-4.5 sections, is energized from a three-header duct electrical distribution system. M-Floor installation is easy—electrical wiring is quick.



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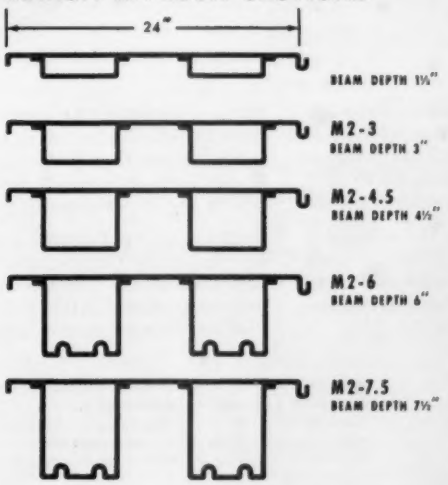

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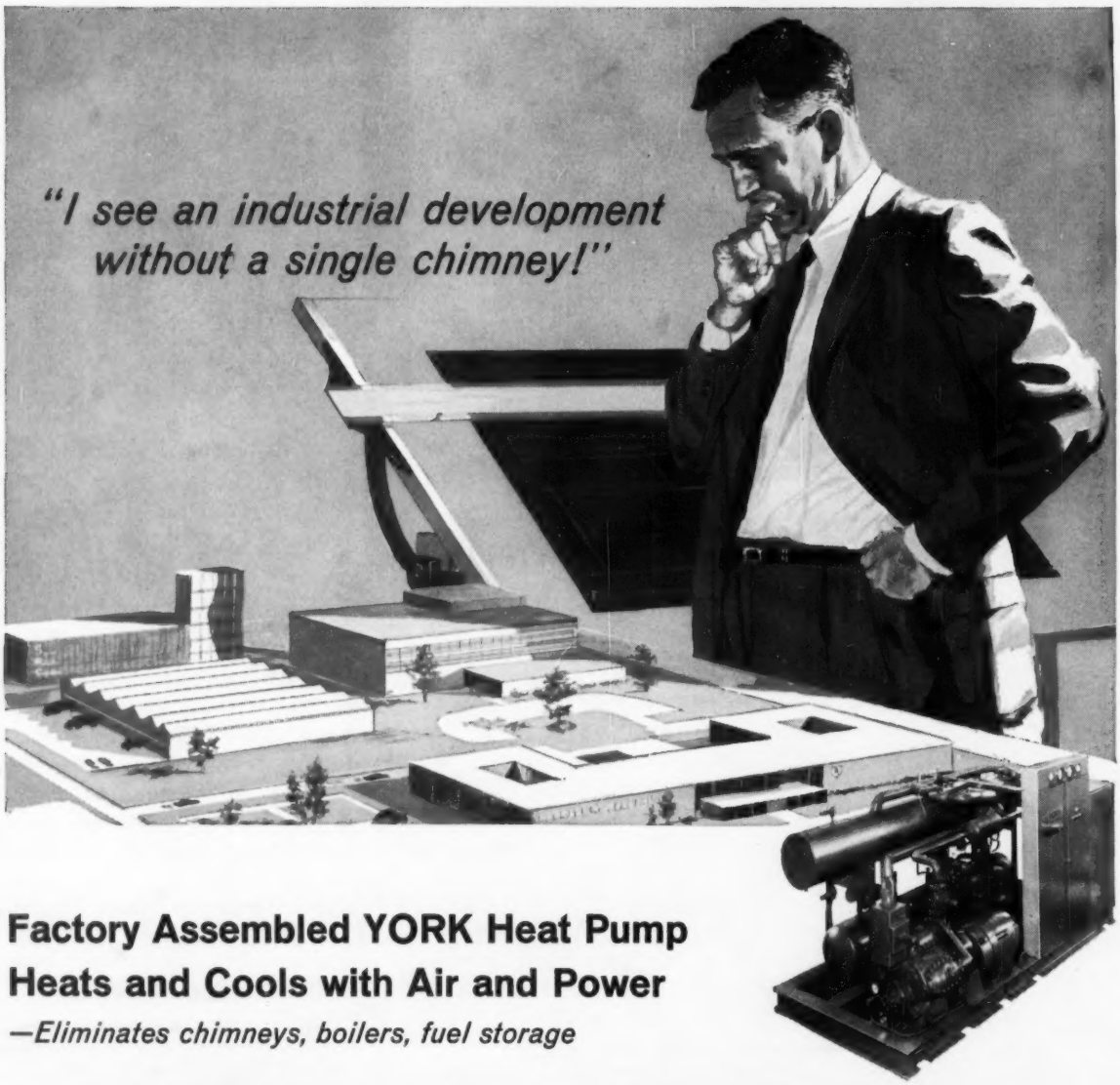

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The Zambesi River cuts across Africa, west to east, about half way between the equator and Capetown. As it goes through Southern Rhodesia, it flings itself over Victoria Falls, and then about 200 miles further along it enters the Kariba Gorge. The first formal survey of this gorge was by William Keppel Steer who reconnoitered the area in 1891 looking for a rail route. After that, from time to time, engineers had a look at the gorge and reported back that it was an ideal site for a hydroelectric project. But until a few years ago, there was no real need for the power that would be produced. Just five years ago, when this project was being argued in Rhodesia, the surveys indicated that the proposed Kariba project would cost £113 million and would have a capacity of 1500 megawatts. This was compared with the entire annual Federal budget of £40 million and the generating capacity of 800 megawatts then in existence.

Two great problems constantly tormented the proponents of the Kariba Dam. The first was politics — the opposing ambitions of the politically powerful in Northern Rhodesia and their counterparts to the south. It took months of adroit maneuvering plus the backing of the World Bank to succeed in the selection of Kariba over other possible sites in the north. The second of the great problems was the Zambesi River, itself, which refused to behave in a statistically proper manner. During the first year of construction on the dam, the floodwaters reached a crest so high that a similar flood could be expected only once in a thousand years. Yet, in the very next year, 1958, the flood was so much greater that the '57 crest was left many fathoms below. A record was set that, statistically, is not likely to be matched again for 10,000 years.

Yet, here in the spring of 1960, the Zambesi River has been harnessed by one of the world's greatest dams, and already a lake is partially formed that will become one of the earth's great bodies of fresh water. This was accomplished by a consortium of consulting engineer firms made up of Sir Alexander Gibb and Partners, of London, working together with Coyne and Bellier, and the Societe Generale d'Exploitations Industrielles, both consulting engineers of France. The project engineer for this undertaking is Dr. Henry Olivier, a native Rhodesian, and one of the most brilliant men produced by that small country.

The contract for the dam itself was given, on the basis of a low bid, to the Italian firm, Impresit. Working with one Italian artisan to five native helpers, these contractors were able to complete the job on time despite the unbelievable difficulties of the floods and a strike of native workers.

The story of this construction project is worth reading. This is one of the great engineering achievements of all times, and it is certainly one of the two great en-

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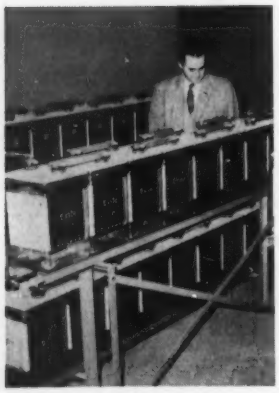

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gineering feats of the past five years (the other being the Mackinac Bridge). *Kariba — The Struggle with the River God* is a competently written reporter's story of the project. Frank Clements is a free lance journalist, and if he has missed many of the interesting aspects of the undertaking that engineers would like to know about in detail, and if he has flubbed some obvious opportunities to fulfill some promises of exciting reading, he at least does not suffer from the usual flaw of the free lance journalist — overstatement and emphasis on the "gee whiz" aspects of his story. In fact, he has a tendency to play down almost to the point of a self-inflicted dullness.

Despite his faults, Clements has investigated carefully, and he is thoroughly familiar with Kariba. He is a passable writer; better than most free lancers. However, his previous work has been limited to magazine articles. This is his first book. Actually, it might have been better as an article, but it is not to be too seriously condemned and can be strongly recommended to engineers as the first book of 1960 to deal at all well with a major engineering project.

•

Book Reviewed in this Issue

Kariba — The Struggle with the River God, by Frank Clements, G. P. Putnam's Sons, New York, N.Y.; $3.95.

•

New Quarterly Journal

The first issue of *Technology and Culture*, a quarterly journal has now appeared. According to the editor, it is designed to appeal to "engineers, to the social scientists, to the humanist — to the academic scholar as well as to the intelligent layman." It is of interest to note that the engineer has priority in the list of those for whom the journal is designed. Time and the engineers will tell if the journal has been well tailored.

Other professions (medicine, science, and law) already have

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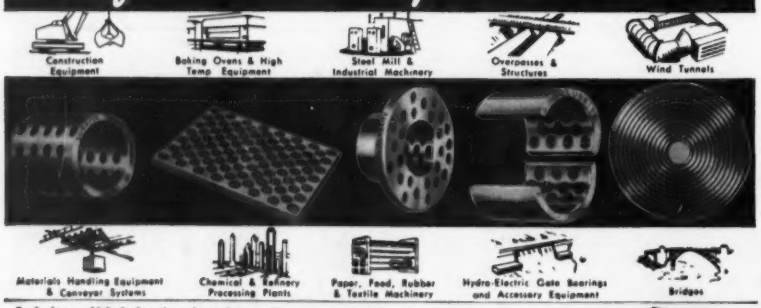
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historians. As a matter of fact, much of the history now being taught in the colleges is the history of law. There are journals published in this country which are given over to the history of science and medicine. By comparison, the history of technology, or engineering, has been neglected.

In this first issue of *Technology and Culture*, several of the contributors stress the neglected state of technological history. The editor, Melvin Kranzberg, Professor of History, at Case Institute of Technology, attributes this neglect to a certain aloofness on the part of scholars – an aloofness rooted in the disdain in which classical antiquity held technology. He argues that technology itself has been viewed for centuries as an inferior subject and the study of its past considered irrelevant. He wonders why the study of past politics, past philosophy, and past literature are all believed to teach valuable lessons and why such claims have infrequently been made for past technology.

Other contributors emphasize the significance of technological history, and the need to study and learn from it. Howard Mumford Jones, Professor of English, at Harvard, in an article entitled "Ideas, History and Technology," also acknowledges the failure of historians and humanists to describe and understand the role technology has played in mankind's fortunes (and misfortunes), but he does not attribute this so much to intellectual snobbery as to the unique knowledge of scholarship and engineering demanded by the discipline. He asks of the historian of technology – the trained specialist – that he communicate to other scholars and to the layman so that the history of technology will assume its rightful place in the record of our culture.

Francis R. Allen, Professor of Sociology, at Florida State University, also stresses the need for the study of the history of technology.

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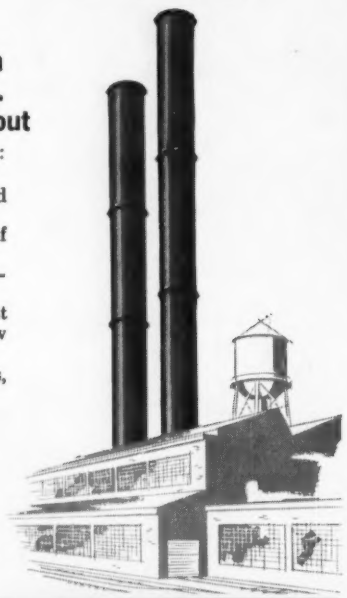

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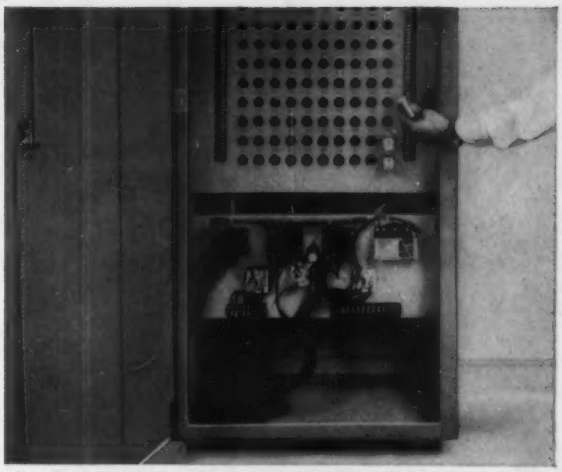
He reminds the reader that the sociologists already have investigated the impact of technology upon social change, but that the area begs further exploitation. In a world permeated by technology, in a world where technology is a key factor in acute problems, researchers have their work cut out for them. Allen asks that studies be made of the influence of TV on a new generation, of the social effects of nuclear energy and nuclear weapons, and of the impact of automation on the worker.

Roger Burlingame, long-time historian of technology and author of a number of popular studies, strikes a different note. While acknowledging the need for further study, he emphasizes the progress made in a few generations. He supports his argument by citing outstanding books that have appeared in recent years, and in so doing he offers a selective bibliography that should interest the would-be student of the history of technology.

In his article, "Work and Tools," Peter Drucker, author and student of business enterprise, assumes the need for the study of the history of technology, but emphasizes the desirability of an examination of the concept of technology. He believes that technology can be comprehended only through an understanding and study of work, and by work he means "the specifically human activity by means of which man pushes back the limitations of the iron biological law which condemns all other animals to devote all their time and energy to keeping themselves alive for the next day, if not for the next hour." The concept of work, in Drucker's opinion, rather than things, will provide the focus for the understanding of the complex system called technology.

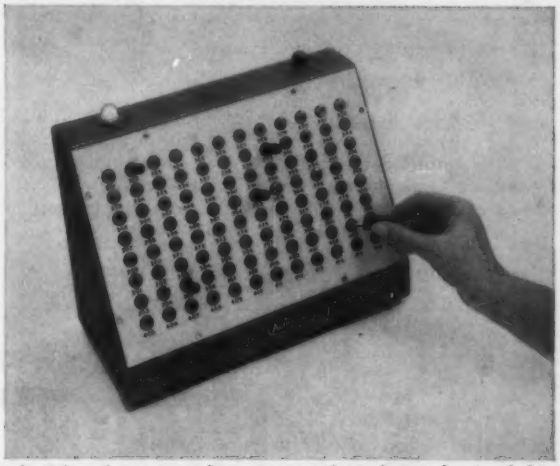
Articles on Louis Sullivan's skyscrapers, on the methods of making chain mail in the early modern period, on the definition of the railway, and on the relationship between science and technology

▲ *Doctors—entering and leaving—dial 3-digit code numbers on small Dial-Registers placed at convenient locations—then press the IN or OUT button.*



▲ *Their IN-OUT status is transmitted by electrical impulses to the control center. There the information is stored for release to any IN-Former which interrogates it.*

▲ *IN-Formers are used by the telephone operator and others to check any doctors' IN-OUT status by dialing his code number. Colored lights reveal his status.*



▲ *When the operator has a message for a doctor she signals him through a plugboard. This flashes a light signal on all Dial-Registers as he dials himself IN or OUT.*

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round out this first issue. These articles best indicate the future content of the journal for the articles mentioned earlier were selected specifically for the first issue in order to indicate the "state-of-the-field" and to plot the course for the future.

Professor Carl Condit, of Northwestern University, in his article on Sullivan's skyscrapers, demonstrates how Sullivan synthesized in his late 19th century buildings the engineering, the ethos, and the aesthetics of his age. He shows how Sullivan's structural techniques were suggested by the pioneering bridge builders of his age. Professor of Metallurgy, Cyril Stanley Smith, through the study of the microstructure of chain mail, draws conclusions with regard to the tools and processes early technicians used. His conclusions question some common assumptions of the historians of technology.

Robert Multhauf, head curator of the department of science and technology at the Smithsonian Institute, surveys the history of the interrelationship (and lack of interrelationship) between science and technology. His article serves as a reminder that this is a significant and timely subject which the historian is obliged to study. Multhauf emphasizes that at the present there are more questions than answers. Professor John Geise of the University of Pittsburgh, in his essay, seeks to define the railway in the hope that a definition may give the historian a clearer concept upon which to base his studies.

These articles, then, with personal notes and book reviews, make up the first issue of a journal designed to appeal to the engineer. Does it hold promise of success? On the affirmative side stands the broad scope of the journal. The contributors include the historian, the sociologist, the applied scientist, the student of business, and the humanist. Their interests range from the things of technology to

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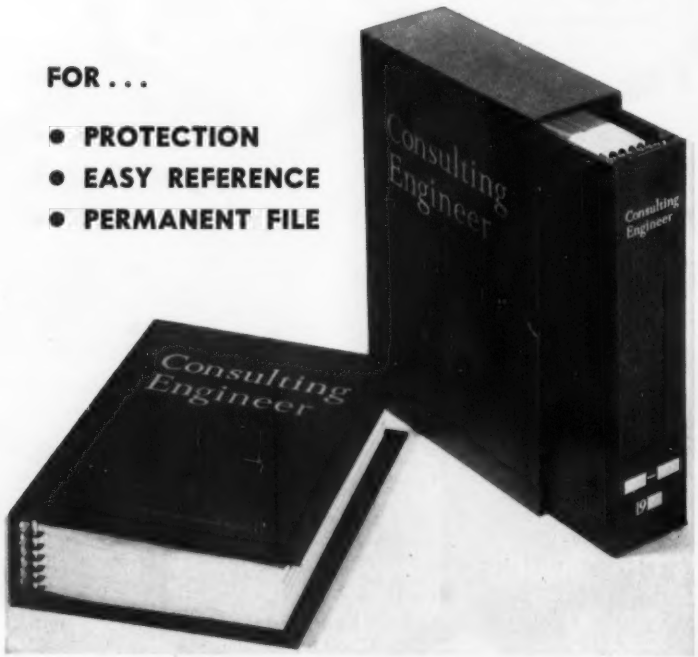

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the ideas of technology, from the impact of technology upon society to that of society upon technology. The journal is infused with the enthusiasms stemming from the belief that the area of study is significant and is intellectually a frontier. The writing is of high quality and not overly laden with the paraphernalia of scholarship. The journal is not pretentious or abtruse. It may well help the engineer to better understand himself and his profession.

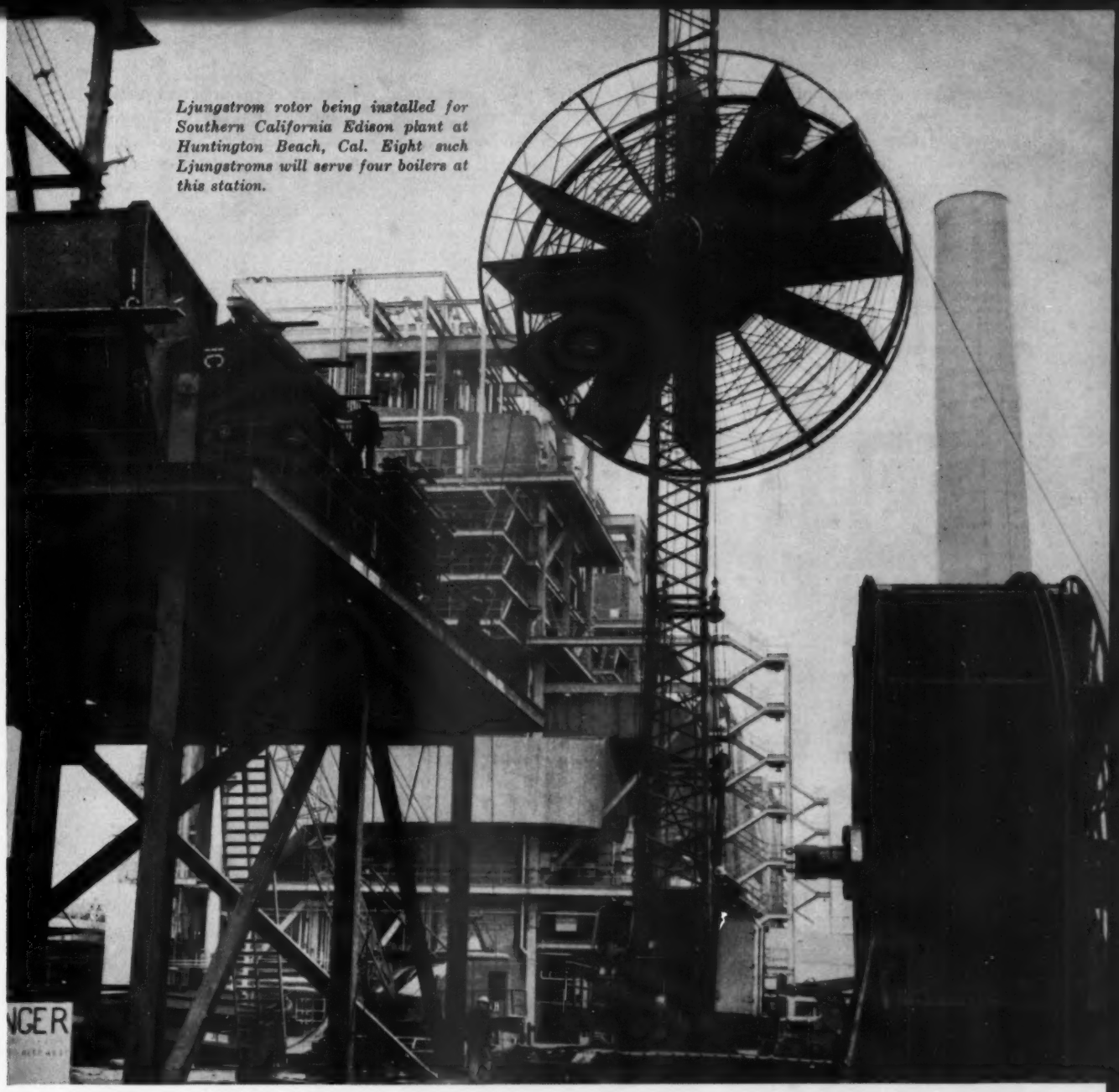
On the negative side stands the indifference of many engineers to their own history (witness the proselytizing in this first issue). In the pages of CONSULTING ENGINEER letters from engineers have appeared calling for a better understanding on the part of engineers of political history (American) and the humanities, but not for the history and "humanizing" of their own profession. This leads to another criticism – this first issue, at least, is primarily analytical and deals with things and ideas. With the exception of Carl Condit's excellent article on Louis Sullivan, the individual working in his technological and cultural environment is ignored. If the journal hopes to help the engineer see himself in perspective, it should include him among the things and the ideas in its pages. Finally, the journal could use sketches and illustrations more extensively. The editors have an excellent model in the recently published multi-volume *History of Technology*.

Dr. Thomas P. Hughes
Washington and Lee University

•

New Technical Books

POWER COST NORMALIZATION STUDIES, CIVILIAN POWER REACTOR PROGRAM-1959 (SL-1674), by Sargent & Lundy; available from the Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C.; $2.50. This is a report published by the Atomic Energy Commission in which eight



Ljungstrom rotor being installed for Southern California Edison plant at Huntington Beach, Cal. Eight such Ljungstroms will serve four boilers at this station.

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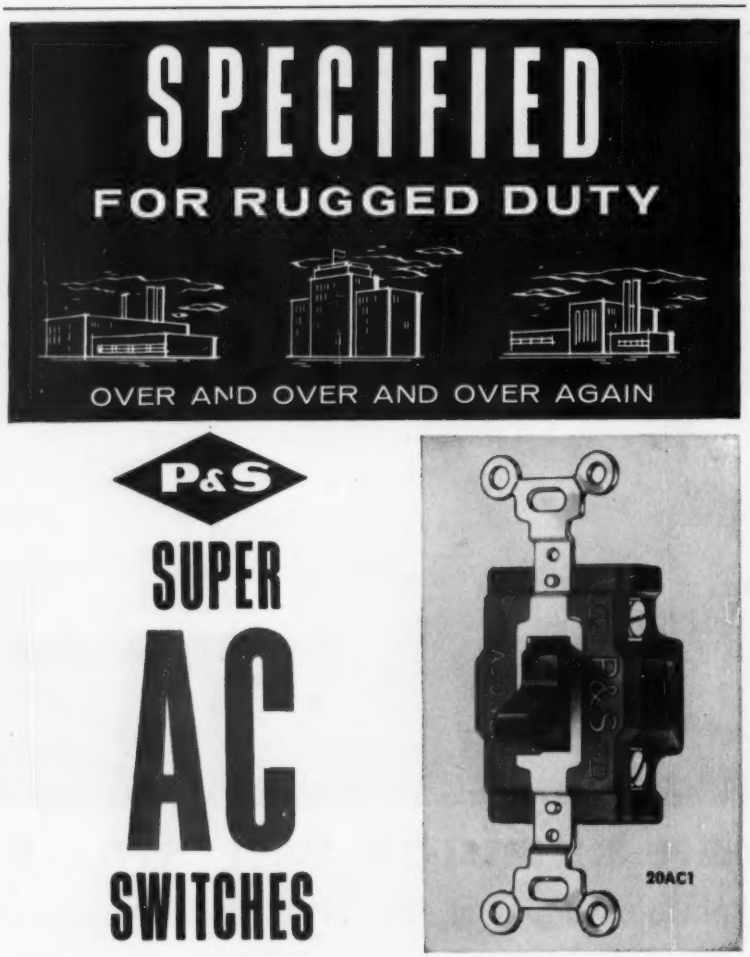
separate status reports of various nuclear power reacctors are reviewed by Sargent & Lundy, nuclear engineering consultants of Chicago, Illinois. SL-1674 includes 164 pages of text, tables, and graphs, and 102 two-page fold-out engineering drawings related to each of these cost estimates. Subjects covered are: scope of work in connection with the cost studies; basic evaluation parameters used in preparing the studies; capital cost breakdowns and summaries for pressurized water, boiling water, organic cooled, sodium graphite, fast sodium cooled, thermal aqueous homogeneous, heavy water, and gas cooled reactor plants; fuel cycle cost evaluation; and operating and maintenance costs.

WORLD DIRECTORY OF RESEARCH REACTORS; published by the International Atomic Energy Agency, Vienna. The second volume of a directory of reactors was published recently by the IAEA. Detailed information about 77 research, test, and experimental reactors in 22 countries is included. All the reactors described are either currently in operation or under construction. A third volume covering the remaining research reactors will be issued later this year. Information for acquiring any one or all of this series may be obtained by writing to the IAEA, Vienna.

AUTOMATING THE MANUFACTURING PROCESS, by George F. Hawley; Reinhold Publishing Corp., New York, N. Y.; $4.95. This is not in the strictest sense a technical book, but more the author's expression of his design philosophy. He concerns himself with the automation of plant processes as divided into three broad classifications: process, assembly, and machining operations. Electronic computers, magnetic tape control, and the other sophisticated automation techniques are considered only as incidental to the production process. Considering the author's purpose, this attitude is an asset.

Automation as a state of mind of the engineer, the manufacturer, and of the worker is developed with consideration for all three points of view. The inventive process is analyzed, the value of models is discussed, and the line between design and engineering is carefully drawn. Hawley does not claim to be a consulting engineer, nor is the consultant mentioned per se, but his approach to the problem is at the professional level. His comments concerning the contractual responsibilities of both the client and the engineer are well thought out.

In summing up, this is a sugar-coated pill. The author's style, though somewhat discursive, is pleasant and logical. The book is brief and adequately illustrated. Consultants in the field of automation would do well to see that their clients had access to it. ▲▲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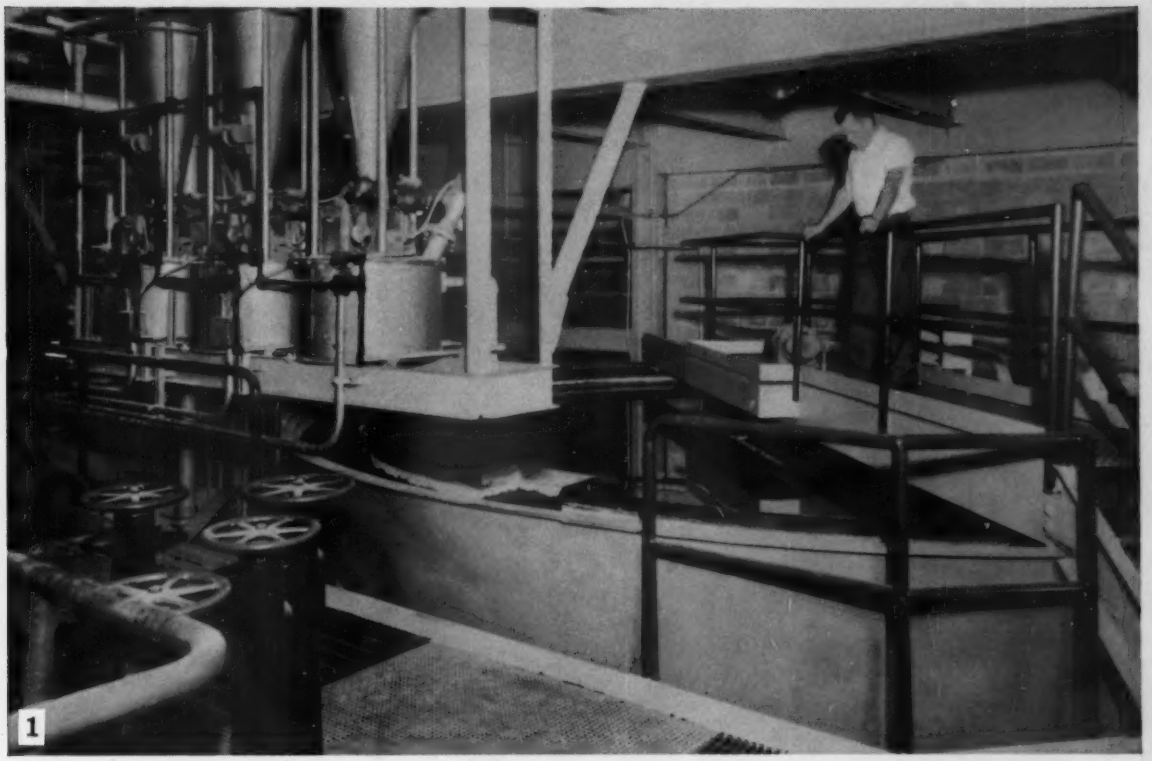

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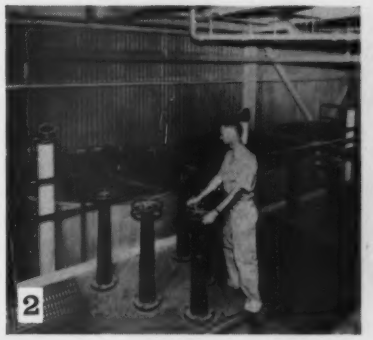

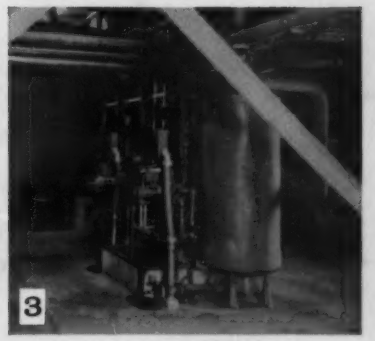

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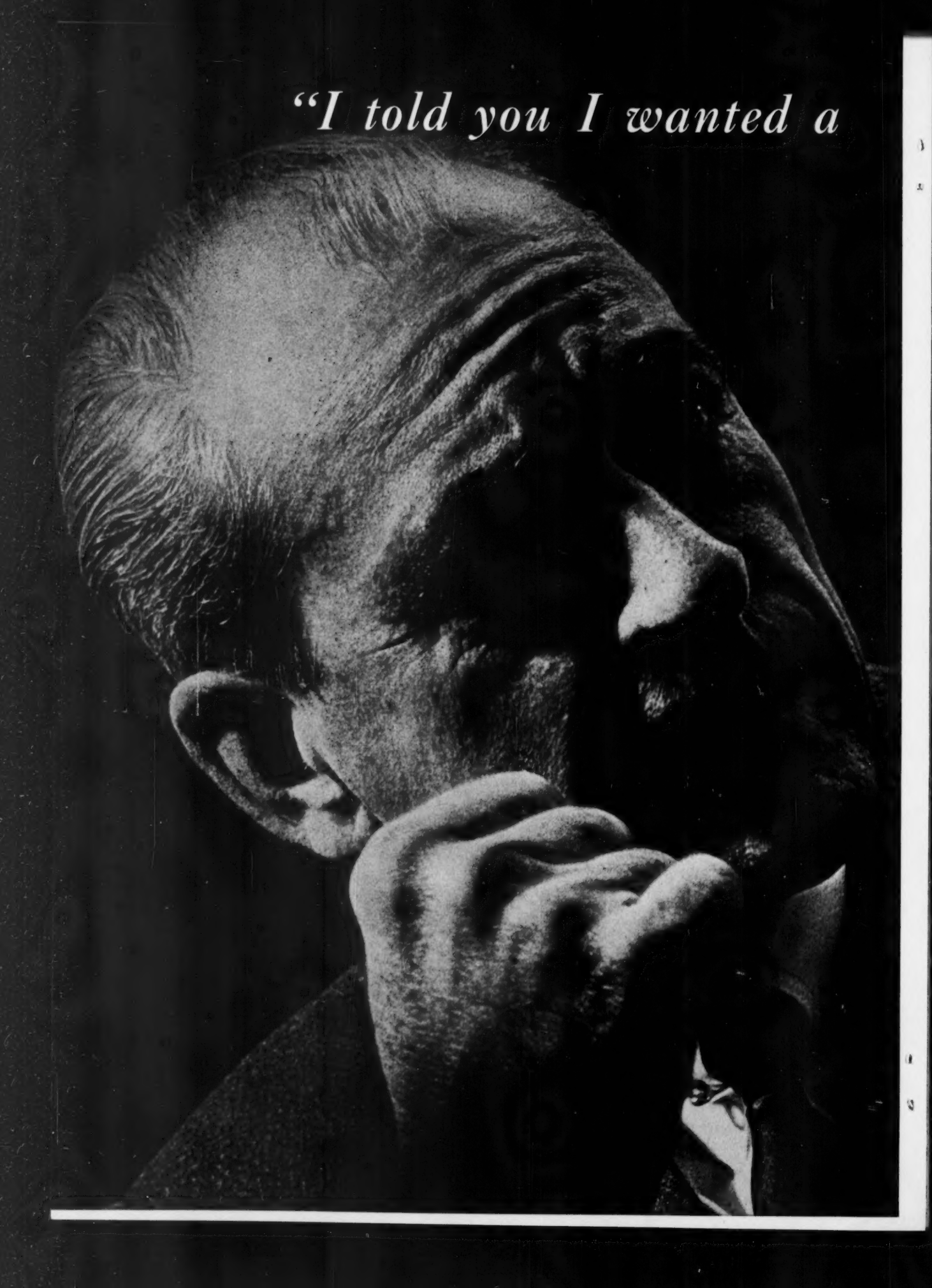
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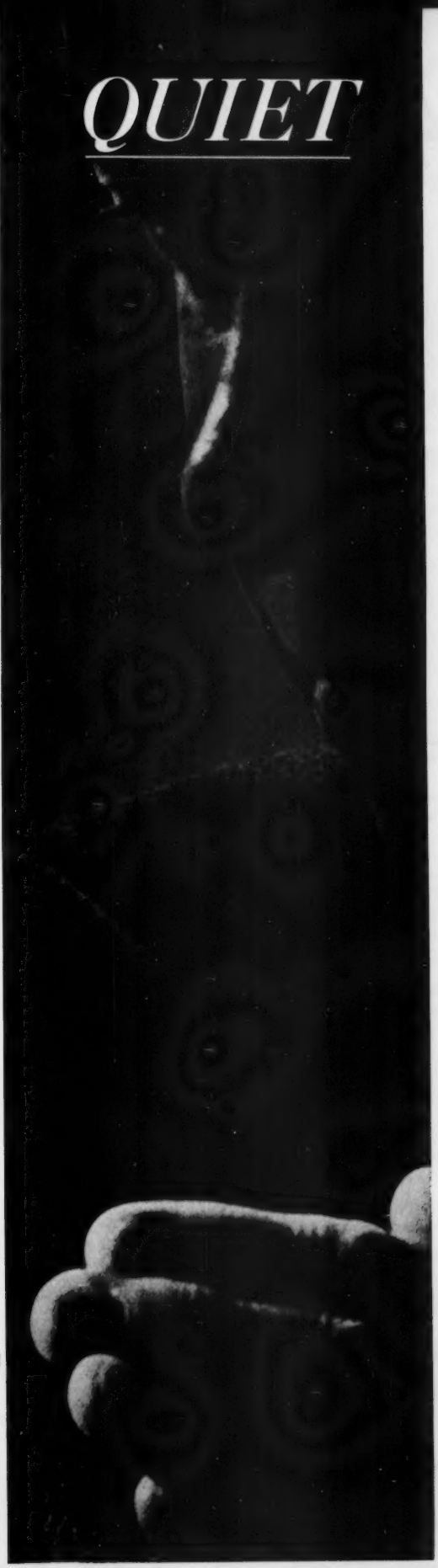

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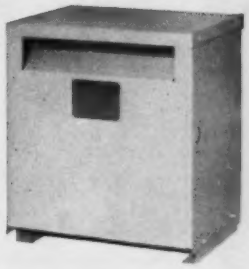

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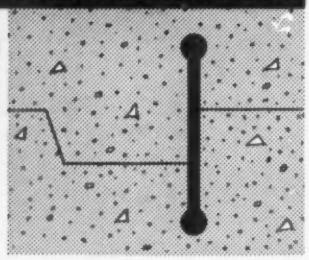

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Consulting Engineers' Calendar

April 12. Arizona Consulting Engineers Association; Annual Meeting, Westward Ho Hotel, Phoenix, Ariz.

April 18. Producers' Council; Spring Meeting and Board Meeting, Mark Hopkins Hotel, San Francisco, Calif.

April 18-19. American Society of Mechanical Engineers, Institute of Radio Engineers, and American Institute of Electrical Engineers; Third Annual Conference on Automatic Techniques, Cleveland-Sheraton Hotel, Cleveland, Ohio.

April 19-21. Building Research Institute; Spring Conference, Statler Hilton Hotel, New York, N. Y.

April 27-30. Western Air Conditioning Industries Association; 3rd Western Air Conditioning, Heating, & Refrigeration Exhibit & Conference, Shrine Exposition Hall, Los Angeles, Calif.

May 4-6. Consulting Engineers Council; Board of Directors Meeting, Gearhart, Oregon.

May 5-6. American Society of Civil Engineers, Engineering Mechanics Division; Conference on Structural Mechanics, Purdue University, Lafayette, Indiana.

May 9-12. Instrument Society of America; Summer Instrument-Automation Conference and Exhibit, San Francisco, California.

May 15-20. American Water Works Association; Annual Conference, Bal Harbour, Florida.

June 1-2. West Virginia University; 1960 Appalachian Underground Short Course, Morgantown, Virginia.

June 2-3. The University of Wisconsin; Engineering Institute on Consulting Engineers' Problems, Wisconsin Center Building, Campus.

June 5-10. American Society of Mechanical Engineers; Semiannual Meeting and Aviation Conference, Statler Hilton, Dallas, Texas.

June 8-11. National Society of Professional Engineers; Annual Meeting, Statler Hotel, Boston, Massachusetts.

June 13-15. American Society of Heating, Refrigerating and Air-Conditioning Engineers; Annual Meeting, Royal York Hotel; Vancouver, B.C., Canada.

June 13-17. American Society of Civil Engineers; Conference on Shear Strength of Cohesive Soils, University of Colorado, Boulder, Colorado.

June 19-22. American Institute of Chemical Engineers; General Meeting, Del Prado, Mexico City, Mexico.

June 20-22. American Society of Mechanical Engineers; Applied Mechanics Conference, Pennsylvania State University, University Park, Pa.

June 20-24. American Institute of Electrical Engineers; Summer General Meeting, Atlantic City, N. J.

June 20-24. American Society of Civil Engineers; Reno Convention, Reno, Nevada.

June 20-25. United States Committee on Large Dams, Reno, Nevada.

July 10-22. Pennsylvania State University; Seminar on Atomic Shelters (architectural and engineering planning aspects, Campus.

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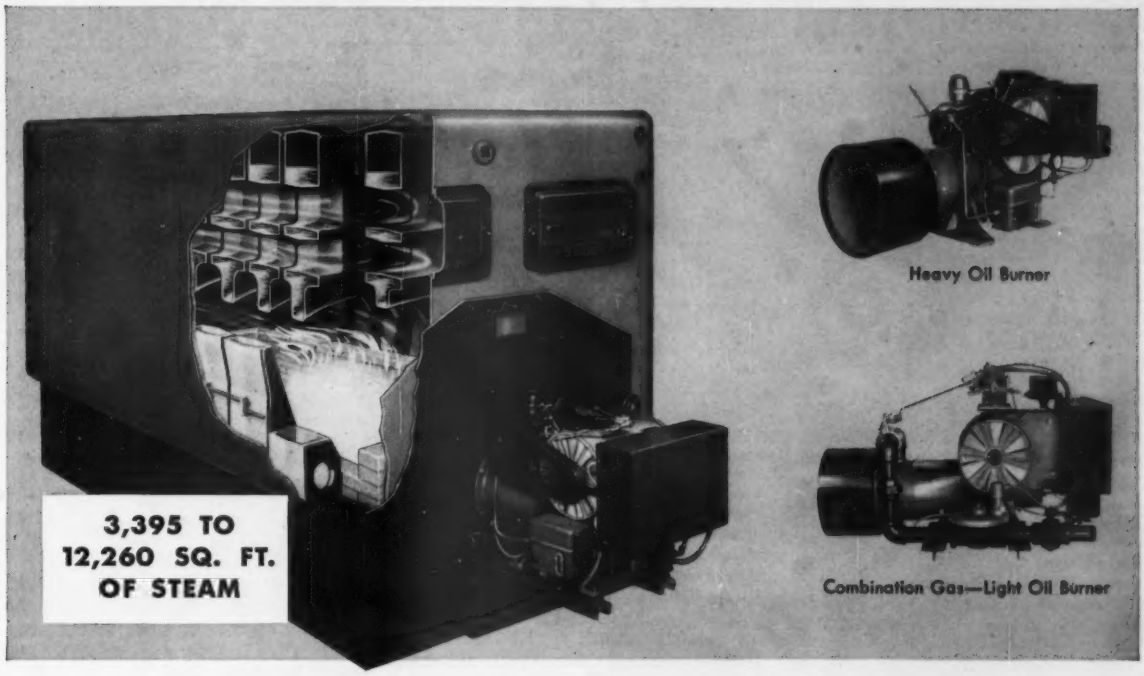

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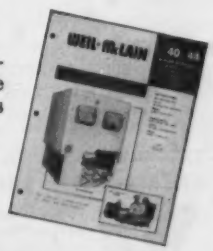

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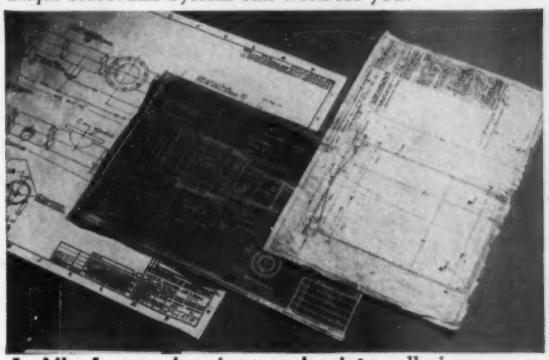

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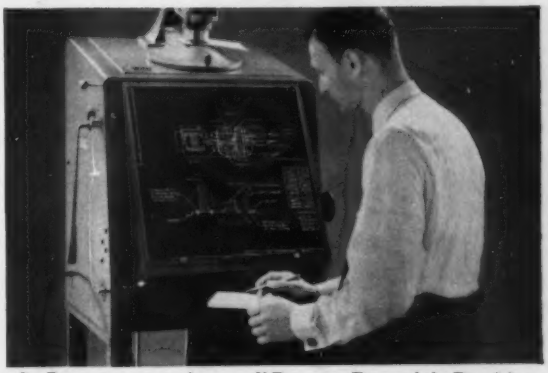

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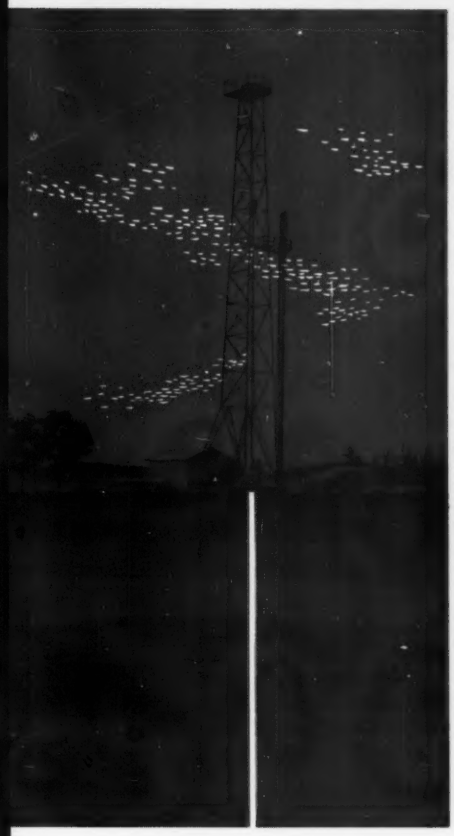

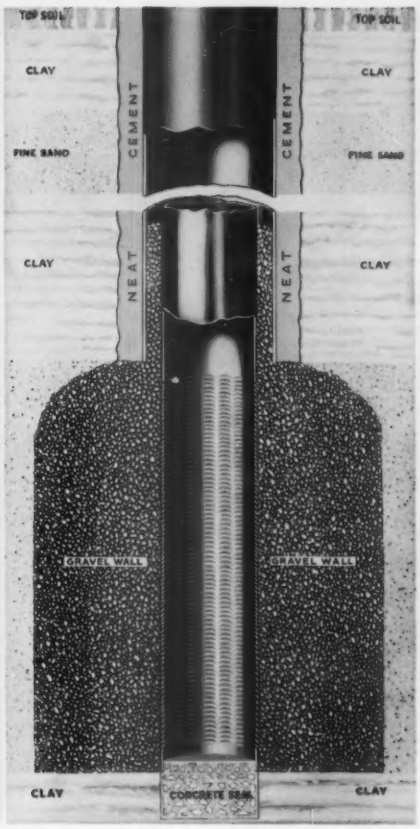

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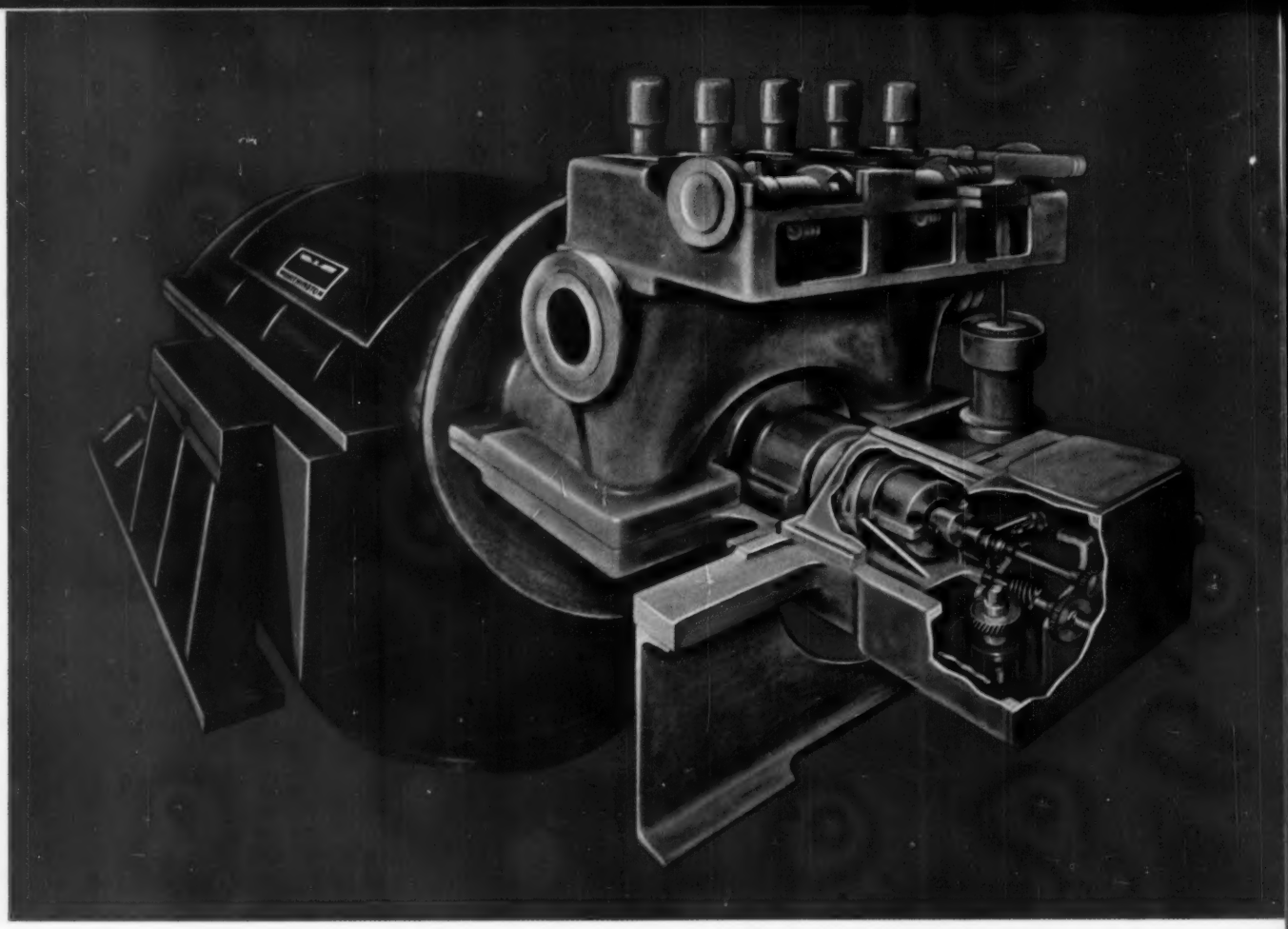

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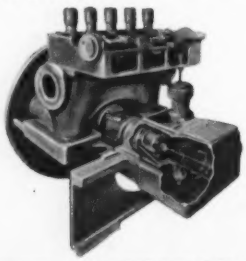

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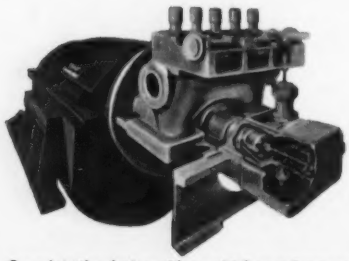

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